

**Managing globally distributed software development using virtual teams:
A Middle East case study**

by

NELSON DENHERE

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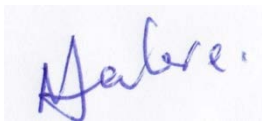
SUPERVISOR: MRS TERTIA HÖRNE

CO-SUPERVISOR: PROF. JOHN ANDREW VAN DER POLL

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Student number: **4669-562-1**

I declare that MANAGING GLOBALLY DISTRIBUTED SOFTWARE DEVELOPMENT USING VIRTUAL TEAMS: A MIDDLE EAST CASE STUDY is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.



SIGNATURE

(Mr N DENHERE)

14/09/2015

DATE

Abstract

Software project development is increasingly becoming geographically distributed especially in today's global business environment. In order to build quality software faster and at a lower cost, companies in industrialised countries are turning to globally distributed software development projects. Emerging countries such as India and Israel are known to have large pools of highly trained software engineers at relatively low cost. However, recent trends have shown that new locations are emerging as developmental sites. Examples of those locations in the Middle East include Oman, Dubai, Abu Dhabi and Qatar. The main attraction of those countries is that they are close to the Arab market. However, distributed development also entails a number of risks and problems, for instance in terms of communication and knowledge transfer between sites, resulting in project failures.

Being the project manager of a team that includes remote members has additional challenges compared to managing co-located team members. These projects face particular challenges that need careful managerial attention. This research aims to examine how globally distributed software development projects are managed in the Middle East. The main question to be answered was "How do companies in the Middle East successfully manage and organise software development in a globally distributed environment?".

We outline the factors that were perceived as important by project managers. We also look at how culture affects the operation of virtual teams in a globally distributed software development environment in the Middle East taking religion into consideration. To understand how these factors influence the success of globally distributed software development projects in the Middle East, we conducted a qualitative case study research involving three different companies operating in Dubai, Oman, Abu Dhabi, India and Pakistan. We used semi-structured interviews as the primary sources of information as these allow highly personalised data.

This research outlines the following specific project management-related areas that need to be addressed to facilitate successful virtual team operation:

- Cross-cultural collaboration
- Tools and technology used to facilitate GSD
- An infrastructure that facilitates communication between virtual teams
- Effective project management

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CHAPTER 1: INTRODUCTION

1. Introduction

Software project development is increasingly becoming geographically distributed, especially in today's global business environment, with limited face-to-face interaction between developers (Agerfalk et al. 2005, Babar, Lescher 2014, Chauhan, Babar 2014). Cusumano (2008) observed that many companies in the U.S., Europe and Japan are now building or contracting for new software products, components, and custom-designed systems that will be created by globally distributed teams, such as teams in India or China, and increasingly in Russia, Eastern Europe, Southeast Asia and Latin America. However, recent trends have shown that new locations are emerging as developmental sites. Examples of these locations in the Middle East include Oman, Dubai, Abu Dhabi, and Qatar. The main attraction of these places is that they are close to the Arab market.

Virtual teams (VTs) are becoming more and more common in global software development projects (Curseu, Schalk & Wessel 2008, Gilson et al. 2015, Igarria et al. 2001). Klitmøller, Schneider and Jonsen (2015) observed that most modern software development companies use virtual teams in software development projects. Virtual software development is the development of software that involves development teams residing in different countries collaborating and performing a variety of tasks, such as planning, controlling, coding, testing, implementing and maintaining, in order to develop new software and achieve common project goals (Oshri, Kotlarsky & Willcocks 2015). Using virtual teams in an information system development project has been largely influenced by recent trends such as globalisation, the shortage of competent software developers at the location in which the companies operate, the availability of competent software developers at a low cost in different parts of the world, and advances in telecommunication (Sanches et al. 2014). In other words, virtual teams have been brought about by the need for organisations to get projects completed as quickly as possible while utilising the skills of project team members who are geographically dispersed. The formation of virtual teams facilitates the incorporation of a wide range of knowledge and expertise possessed by individual members into a collective body of knowledge needed to conduct effective group problem-solving activities (Khan, Niazi & Ahmad 2011).

1.2 Software globalisation

The introduction of the internet, intranets, and extranets coupled with the low cost of telecommunication have helped the development of virtual work groups and virtual companies (Babar, Lescher 2014, Casey 2010b, Colomo-Palacios et al. 2014). This has enabled software development and maintenance to be done in distributed locations (Andres 2002). Some software companies are contracting remote third-part companies, while other software companies are setting up subsidiaries in low-cost economies to do software development and maintenance (Casey 2010b). This approach is known as Distributed Software Development (DSD), Global Software Development (GSD), or Global Software Development (GSD).

Sahay (2003) defines Global Software Development as “*software work undertaken at geographically separated locations across national boundaries in a coordinated fashion involving real time (synchronous) and asynchronous interaction.*” Parvathanathan et al (2007) described GSD as software development that uses teams from multiple geographic locations who share workflow and deliverables. The term “development” in this context describes the entire software life cycle, including requirements analysis, design, implementation, testing, deployment, maintenance and support.

1.3. Project management in the global software development environment

A distributed environment introduces considerable challenges to the project management of GSD teams. Being the project manager of a team that includes remote members has additional challenges compared to managing co-located team members (Casey, 2010a). These projects face particular challenges that need careful managerial attention. There are many problems that need to be addressed when establishing a globally distributed development team, such as language and cultural differences, trust factors, communication across temporal and spatial distances and a lack of shared contextual awareness. This research will look at the following specific project management-related areas that need to be addressed to facilitate successful virtual team operations:

- Cross-cultural collaboration
- Tools and technology used to facilitate GSD

- An infrastructure that facilitates communication between virtual teams
- Effective project management

1.4 Research Motivation

While many studies have been carried out regarding the challenges faced in globally distributed software development projects and the possible solutions thereof, there is a lack of qualitative studies that concentrates on software companies in the Middle East. Research done in other countries cannot be applied to the Middle East because of a different cultural identity and work ethics. This called for the need to conduct research focusing on software companies operating in the Middle East.

1.5 Research objective and questions

The objective of this study is to develop a comprehensive understanding of how to manage globally distributed development projects in the Middle East. The main research question is:

RQ 1. How do companies in the Middle East successfully manage and organise software development in a globally distributed environment?

To answer this question, the following sub-questions were identified:

RQ 2. What factors contribute to the success of globally distributed software projects in the Middle East?

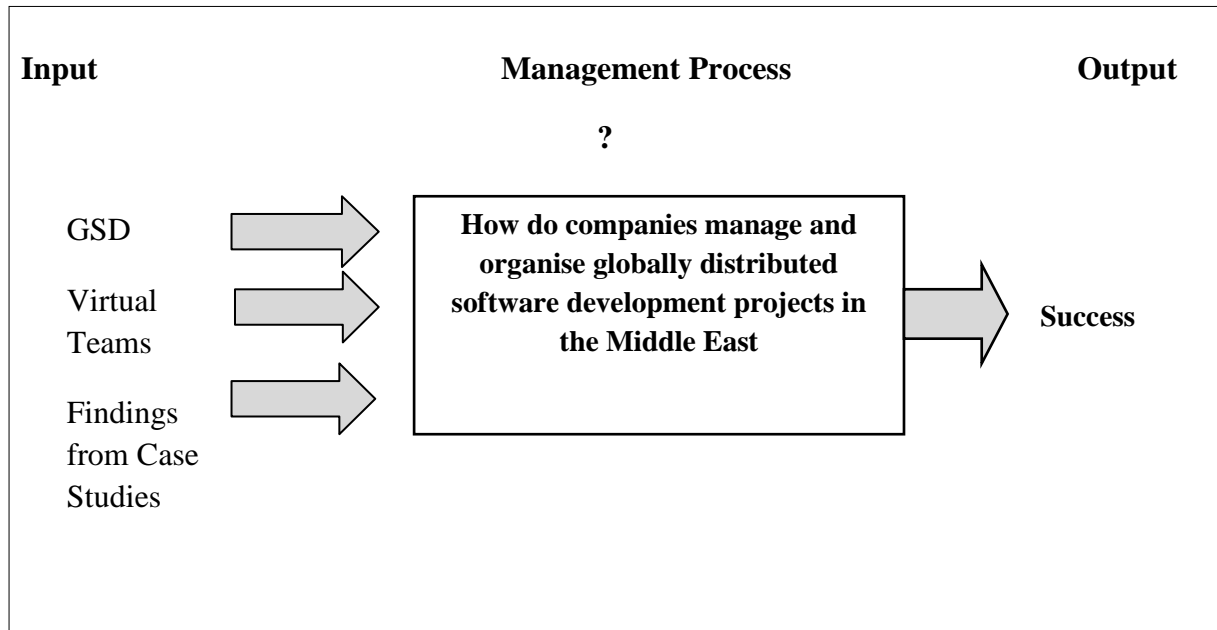
RQ 3 What are the best practices globally distributed software development teams engage into ensure success of projects in the Middle East?

The outcome of this research aims to identify management practices, methods and techniques that could be used in managing globally distributed software development projects and to develop a theoretical management framework that stipulates different practices, approaches and methods that are used to manage distributed software development projects in the Middle East. Factors and variables that affect the successful implementation of globally distributed software development projects in the Middle East will be analysed.

1.6 The focus of this research

The focus of this research is on the management aspects of globally distributed software development projects in the Middle East, as depicted in figure 1.

Figure 1: Research focus



The proposed theoretical management framework is based on the following: (a) related research on virtual teams that conducted in-depth studies of the management of virtual teams in a global software development environment; (b) research on the management of global software development and the role of social aspects in global collaboration; (c) the empirical evidence gathered from case studies of software companies based in the Middle East.

1.7 Thesis structure

This chapter has laid out the context of GSD and the research questions that guide this study. The structure of the thesis is as follows:

- Chapter 2 presents a critical review of the literature relevant to the management of GSD. The chapter outlines the challenges of using a virtual team in globally distributed software development projects and the management and collaboration of virtual teams in GSD.
- Chapter 3 explains the choice of a qualitative case study methodology adopted in this research and the case selection criteria. It also describes the research process and specific techniques used for data collection and analysis.
- Chapter 4 presents the data analysis and results of three case studies.
- Chapter 5 compares the research findings with the literature. Propositions are formulated.

- Chapter 6 concludes the thesis by presenting the theoretical framework that identifies factors contributing to success in GSD, and outlining the contributions to research and practice, the possible limitations of the research, and suggestions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of the academic body of knowledge pertaining to the management of globally distributed software development projects. The main goal of searching for relevant literature was to find theoretical and empirical research that focus on the management of globally distributed software development projects and virtual teams. The literature review is organised in the following way: section 2.2 defines distributed software development, explains the advantages of distributed software development, and highlights some of the challenges faced by project managers of distributed software projects. Following this, section 2.3 discusses the management of globally distributed software development. Section 2.4 explains some criteria used to measure success in information system projects in general while section 2.5 concludes the chapter with a summary of the potential factors that may contribute to the success of distributed software development.

2.2 Distributed software development

This section presents the existing literature on globally distributed software development. The conceptual foundations in the existing literature are analysed in order to construct a common framework of reference concerning globally distributed software development. Advantages of distributed software development together with the challenges faced by project managers of distributed software projects are also discussed.

2.2.1 Conceptual Foundations

Many different conceptualisations have been used to describe the practices of globally distributed software development team members in projects or organisations. Four common conceptualisations are frequently used, namely:

- Virtual teams (Etter, Orsak 1996, Powell, Piccoli & Ives 2004, Gibson, Gibbs 2006a)
- Offshore outsourcing (Kaiser, Hawk 2004, Pfannenstein, Tsai 2004)
- Virtual organisations (Bleecker 1994, Markus, Manville & Agres 2014a)
- Global software development (Damian, Moitra 2006, Herbsleb, Moitra 2001)

The majority of the literature studies shows that virtual teams are widely used (Babar, Lescher 2014, Casey 2010b, Andres 2002, Bleecker 1994, Tjørnehøj et al. 2014, Verner et al. 2014, Carmel 1999). Virtual teams are mainly linked by computer and telecommunication

technologies. Different definitions of virtual teams have emerged as more research are conducted. The common understanding of the majority of definitions is the idea that virtual teams are teams that rely heavily on technology-facilitated communication and the team members are globally distributed (Martins, Gilson & Maynard 2004). The term “global” implies those virtual team members who are involved in software development efforts, span separate countries and time zones. The additional characteristics of virtual teams are electronic dependence, structural dynamism and cultural diversity (Powell, Piccoli & Ives 2004, Martins, Gilson & Maynard 2004, Gibson, Gibbs 2006). Furthermore, the term “team” implies that the efforts of the team members complement each other and that they display high levels of interdependency (Powell, Piccoli & Ives 2004). There are a number of ways of assembling virtual teams mentioned in the literature. Martin (2004) pointed out that virtual teams can be assembled from the same organisation with members residing in different locations. Virtual teams can also be outsourced from different organisations (Oshri, Kotlarsky & Willcocks 2015). When virtual teams are taken from different organisations, it is often referred to as “offshore outsourcing”.

The term “outsourcing” places special importance on cross-organisational transactions and it also suggests the use of outside agents to execute organisational activities. This can apply to the use of contract software development teams as well as to third party management. Additionally, the term “offshore” emphasises a crossing of national borders. The term “offshore” indicates that team members are outsourced from other countries (Šmite, Calefato & Wohlin 2015). Offshore outsourcing can include a virtual team setting which is characterised by high levels of interdependency and integration (Kaiser, Hawk 2004, Dibbern et al. 2004).

Virtual organisations are defined as flexible networks of independent, globally-distributed entities (individuals or institutions) that share knowledge and resources and work towards a common goal (Curseu, Schalk & Wessel 2008). Virtual organisations are different from offshore outsourcing in the sense that offshore outsourcing is limited to cross-company transactions. Virtual organisations are also different from virtual teams because virtual team groups with distributed members display high levels of interdependency and integration. Markus, Manville and Agres (2014) observed that open-source software movement has, in particular, provided inspiration for the development of the virtual organisation conceptualisation.

Software development carried out by distributed software developers has also been termed “global software development”. Markus, Manville and Agres (2014) and Herbsleb and Moitra (2001) explained that the term “global software development” is based on the observation that software development is increasingly a multisite, multi-cultural, globally-distributed undertaking. Conceptually, global software development can therefore be compliant with all of the three concepts mentioned above. For instance, the emphasis of extensive technology-supported teamwork and communication in global software development research is similar in much of the virtual team research (Ebert, De Neve 2001). Other global software development research focus on going beyond communication technologies by reducing intensive collaboration (Carmel 1999). This approach is also suggested in offshore outsourcing and virtual organisation research.

However, in general, “global software development” does not appear as established or as clearly defined a concept as “virtual teams”, “offshore outsourcing”, and “virtual organisations”. The conceptualisation used in this study is the concept of a “distributed software project”. In this context, a distributed software project comprises a virtual team, an offshore outsourcing arrangement, a virtual organisation and a global software development effort. Each of the four concepts therefore encompasses relevant research when investigating the management of distributed software projects. However, the research topic emphasises “software projects”, which often rely on the use of teams when developing software. The study therefore has a particular focus on virtual teams and global software development research.

2.2.2 Distance in globally distributed software development

The International Conference on Global Software Engineering identified three types of distances in distributed software development, namely geographical distance, temporal distance and socio-cultural distance (Damian, Lanubile 2004). The distributed aspect of software development introduces the most obvious distance which is geographical distance on a global scale. Herbsleb (2007) describes socio-cultural distance as the degree to which the cultural backgrounds of the development team differs. The temporal distance occurs when two or more team members reside in different time zones. Three distances, namely geographical, temporal and socio-cultural are thus accepted to define distance of globally distributed software development (Agerfalk et al. 2005, Carmel 1999).

Geographical distance

Rather than defining geographical distance as the distance in kilometres that separate team members or development sites, Agerfalk et al (2005) defined geographical distance as the effort required for one team member to visit another. If two locations have good and efficient transport systems, they can be considered as close to each other despite the distance that separates them. The same cannot be said if two locations have poor transport infrastructures, even if they are close to each other. There are several factors that affect the ease of relocating, such as duration of travel, and time and effort required to get the necessary travel documents such as visa and/or permits. Herbsleb and Grinter (1999) pointed out that low geographical distance offers greater opportunities to team members for more unplanned informal communication and face-to-face interaction.

Temporal distance

Agerfalk et al (2005) describes temporal distance as a measure of the dislocation in time faced by two members wanting to communicate. This can be caused by a number of factors, such as the team members residing in two different time zones and having different working hours and different working days. Temporal distance reduces the number of overlapping working hours and hence reduces the chance of synchronous communication between team members. Sarker and Sahay (2004) pointed out that when working hours between remote sites do not overlap, response time greatly increases and the opportunity of real-time collaboration between those remote sites is also reduced.

Socio-cultural distance

Kotlarsky and Oshri (2005) and Dafoulas and Macaulay (2002) define culture as the shared values, norms and behaviours that are learned unconsciously in a social collectivity such as a country and plays a major role in determining how people perform their work based on individual patterns of thinking, feeling and acting. Socio-cultural distance is a measure of an actor's understanding of another actor's values and normative practices (Agerfalk et al. 2005). As recognised by Kotlarsky and Oshri (2005), culture can have a huge effect on how people interpret a certain situation, and how they react to it. It is a complex dimension, involving organisational culture, national culture and language, politics, and individual motivation and work ethics. It is possible to have a low socio-cultural distance between two actors from different national and cultural backgrounds who share a common organisational culture, but a

high distance between two co-nationals from very different company backgrounds. Certainly, geographical distance may imply increased cultural distance. However, the cultural distance can be large even with low geographical distribution. Similarly, a huge geographical distance does not automatically mean huge cultural differences.

2.2.3 Why global distributed software development?

In this section, we present reasons why companies engage in global software development. Global software development comes with benefits to software development companies. Some of the more common and well-established motivators for globally distributed software development include the following (Herbsleb, Moitra 2001, Carmel 1999, Carmel, Agarwal 2006):

- Differences in development costs favouring dispersing team geographically.
- Limited trained workforce in technologies that are required to build today's complex systems.
- A “shift”-based work system facilitated by time zone differentials allowing for shorter times to market.
- Advances in infrastructure (e.g., Internet bandwidth available and software development and integration tools).
- A desire to be “close” to a local market.

Differences in development (Reduced Development Costs)

Several literature sources indicate that GSD has enormous potential for reducing development costs (Damian, Moitra 2006, Šmite, Calefato & Wohlin 2015, Ebert, De Neve 2001, Damian, Lanubile 2004). If parts of the software development and maintenance work are moved to lower-wage countries, it will effectively reduce the cost of development. Conchuir et al (2009) states that “*A base annual salary of U.S.\$15,000 for a software developer in India, is one quarter of the salary of an Irish developer, who in turn earns half that of a developer in the US.*”

A “shift”-based work system facilitated by time zone differentials allowing for shorter times to market

GSD can greatly reduce the development period, as developers will be distributed across different time zones (Šmite, Calefato & Wohlin 2015, Ebert, De Neve 2001, Conchúir et al.

2009). This strategy will increase the number of working hours per day. This concept is known as the ‘follow-the-sun’ development model. In order to get full benefit from this concept, the software life cycle has to be divided and assigned to virtual teams located in different time zones. This arrangement might complicate coordination since meetings between team members cannot be held during normal office hours.

Advances in infrastructure

Advancement in communication technology provides cheaper communication media for virtual teams to communicate during software development. Collaborative tools such as Skydrive™ facilitate file-sharing between remote teams.

A limited pool of trained workforce in technologies that are required to build today’s complex systems

Countries such as India, China and Russia have large pools of competent software developers and generate many graduates in the IT field. On the other hand, Middle Eastern countries suffer from a shortage of software developers and do not generate enough IT graduates to satisfy the market. The shortage has to be covered by using GSD.

A desire to be “close” to a local market

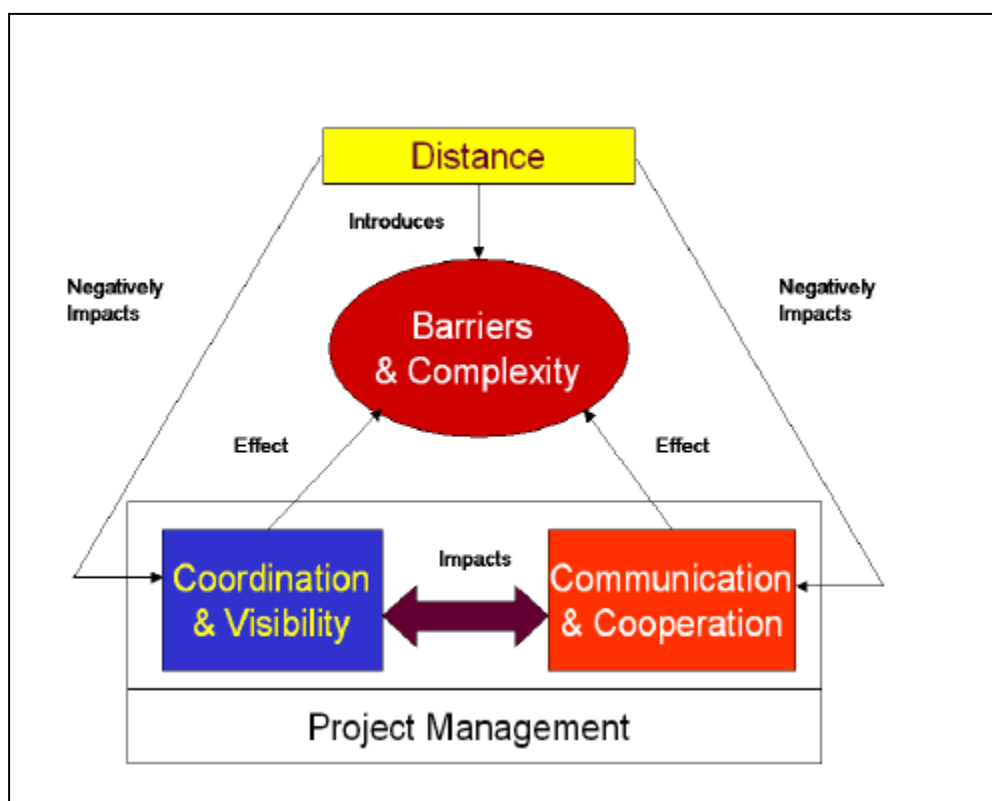
Being close to the customer has a number of business advantages. This allows software companies to use the locality of specific expertise to develop customised solutions. For example, virtual teams residing in Oman have been tasked to translate software from English into Arabic. This has enabled the majority of Arab users to use these software products.

2.2.4 Challenges of global software development

Managing virtual teams in globally distributed software projects is more difficult and complex than it is for a co-located team. This is because the project task is divided and distributed across different sites. Task division and distribution can make it difficult for a software development team to understand individual tasks, its main purpose (Babar, Lescher 2014, Holmstrom et al. 2006) and their own contribution to the overall project (Herbsleb, Moitra 2001). Since software developers are recruited from different parts of the world, there may probably be an issue of tool incompatibility. This is because each site is likely to use different programming languages, operating systems and development tools (Sarker, Sahay 2004, Dubé, Paré 2001).

Holmstrom et al (2006) identified communication as one of the major challenges in software project management. In distributed projects, communication is difficult as team members are separated by distance and time. Effective communication is often hindered by low information exchange (Casey 2010a) absence of face-to-face communication (Andres 2002) and absence of informal communication (Casey 2010b). Coordination, communication and cooperation are all negatively affected by distance (Srivannaboon, Milosevic 2006). Additionally, this can also negatively affect trust (Crisp, Jarvenpaa 2015, Casey 2010a, Pinjani, Palvia 2013) innovation and creativity (Leidner, Kayworth 2006), as well as management (Casey 2010a). Since communication is mostly done electronically, it is impossible to apply traditional conference management tools for virtual meetings (Sarker, Sahay 2004). Figure2 shows that distance can negatively affect coordination and communication. Cooperation within virtual teams is important to project success.

Figure 2: The impact of distance on virtual team operation (Casey 2010b)



As mentioned before, distributed projects come in many shapes and sizes. It is not uncommon to have multiple divisions, organisations, cultures and languages represented in a project. Many of the participants have often never met before, they may have different levels of domain experience and may have motivations that conflict with the goals of the project. All these factors conspire to make it increasingly difficult to coordinate across teams, manage

evolution and monitor progress (Babar, Lescher 2014, Casey 2010b, Carmel 1999, Battin et al. 2001, Carter et al. 2015). Past studies have shown that tasks may take about 2.5 times longer to complete in a distributed setting versus a co-located setting (Herbsleb, Mockus 2003).

It has been well established that until people meet face-to-face, they may find it difficult to remotely coordinating complex tasks (Carmel, Agarwal 2006). When an issue or question arises, it often is quite difficult to know who to turn to. An individual at a remote site often does not have insight into the activities of other people who are not at the same site. Because of this, much time can be spent trying to find someone who can help (Casey 2008).

Cultural and language differences also come into play. This happens more often when the project is distributed nationally and when sites and team members do not share a common native language (Leidner, Kayworth 2006, Casey, Richardson 2005). This can result in misinterpretations and misunderstanding among team members (Dube & Pare, 2001). Different cultures and styles can often cause confusion and frustration (Carmel, Agarwal 2006). This may be caused by different work ethics. This leads to decreased conflict-handling capabilities, lower efficiency or even paralyse a distributed software project.

In general, when a project is distributed across time, space and culture, it is difficult for distributed teams to function as smoothly as co-located teams (Holmstrom et al. 2006). Many other logistical issues often end up taking more time than anticipated. Figuring out how to align technical infrastructure, dealing with connectivity issues imposed by a particular network topology, figuring out how to align management practices and organisational processes where required, etc., are all difficult and time-consuming concerns that use valuable resources and time from the project (Holmstrom et al. 2006). If the factors mentioned above are not considered and addressed, the likelihood of producing a quality product within schedule and budget greatly diminished. In fact, paying attention to these factors does not guarantee success by any stretch of the imagination (Holmstrom et al. 2006). Table 1 summarises the major challenges reported in the literature. Many challenges in distributed software development which have been cited below have motivated a large amount of research. Despite this, problems still persist. Hence, more research addressing these challenges needs to be carried out.

Table 1: Summary of challenges in global software development

Challenges	Reference
Breakdown of traditional coordination and control mechanisms	(Andres 2002)
Loss of communication richness	(Khan, Niazi & Ahmad 2011)
Lack of understanding of project visibility	(Ågerfalk 2004)
Language barriers	(Ågerfalk 2004, Klitmøller, Schneider & Jonsen 2015)
Misunderstandings caused by cultural differences	(Ågerfalk 2004, Klitmøller, Schneider & Jonsen 2015, Leidner, Kayworth 2006)
Loss of team cohesion and motivation to collaborate	(Ågerfalk 2004, Klitmøller, Schneider & Jonsen 2015)
Asymmetry in distribution of information among sites	(Carter et al. 2015)
Difficulty in collaborating due to different skills and training, expertise in different tools and technologies, mismatch in IT infrastructure	(Sanches et al. 2014, Kotlarsky, Oshri 2005, Ulhas, Lai & Wang 2015)
Lack of informal, inter-personal communication	(Cataldo, Herbsleb 2008, Cusumano 2008)
Difficulties to work in different time zones	(Casey 2008)
Delays in distributed collaborative work processes: unproductive waits for the other side to respond with clarification or feedback (caused by time zone differences and different interpretations)	(Casey 2010a)

2.3 Management of globally distributed software development projects

To discuss the management of globally distributed software projects, it is vital to start by defining a software project. Schwalbe (2012) defines a software project as a temporary endeavour undertaken to create a unique product, service or result. Hardware, software and networks are used to create a product, service or result.

Kerzner (2013) defined software project management as the art and science of planning and leading software development projects. Software project management involves software project planning, project scheduling, risk management and managing people. Software project managers need to manage the project effectively within the constraints of limited resources, such as financial and technological resources. This needs to be accomplished by utilising the personnel, technical capabilities and time available.

The role of the software project manager is to determine objectives. According to Tsui, Karam and Bernal (2013) software project managers also need to define, create, evaluate, and select alternatives to achieve those objectives and to monitor and control their implementation. This is achieved through effectively planning, organising, staffing, leading, controlling and coordinating the project. The project manager is required to have the ability to arbitrate, appease, admonish, praise, inspire and motivate those who they manage and come in contact with (Tsui, Karam& Bernal 2013). This role also requires effective people management, business management, risk management and expectation management (Binder 2009).

Research on the management of GDS started around 1990s and by the late 90s (e.g. Carmel 1999), it has established itself as a separate research area. Historically, it focused on traditional software development. Despite growing experience in the area of GSD, research on this topic that focus on Middle East software companies is still limited. Existing research is very fragmented and focuses on different aspects of distributed collaboration and at varying levels of analysis. IS literature that focuses on the management of GSD *projects* is examined in depth to develop a theoretical lens for studying GSD projects in Middle East. Table 2 provides an overview of the core literature on the management of GSD projects, the main topics addressed in this literature, the research approaches applied and the data sources (marked as ‘V’).

Table 2: Overview of core literature on management of GSD projects

	(Casey 2010b)	(Clark, Clark & Crossley 2010)	(Oshri, Kotlarsky & Willcocks 2015)	(Carmel, Agarwal 2006)	(Casey 2008)	(Crawford, Pollack 2007)	(Carter et al. 2015)	(Crisp, Jarvenpaa 2015)	(Klitmøller, Schneider & Jonsen 2015)	(Ulhas, Lai & Wang 2015)	(Angolia, Lesko 2014)	(Chauthan, Babar 2014)	(Colomo-Palacios et al. 2014)	(Binder 2009)
Research approach:														
Qualitative case study	V	V		V	V		V		V	V	V	V	V	V
General overview			V			V								
Quantitative survey								V						
Data source														
Actual GSD project	V	V	V	V	V	V	V		V	V	V	V	V	V
Students								V						
Main issues discussed														
Cross cultural awareness	V													V
Team building		V	V				V							V
Trust			V					V						V
Effective communication				V	V				V					
ICT infrastructure				V						V		V		
Collaborative technology										V		V	V	
Project management	V				V	V					V			V

According to Binder (2009), although many software companies have implemented software using distributed teams, only a few have effectively established sufficient practices for supporting managers and developers. As outlined above, there are many problems associated with distributing software development. In order to alleviate those problems, it is important to adopt a management approach for distributed collaborative work (Komi-Sirviö, Tihinen 2005).

Table 2 shows that the vast majority of the core literature are based on the research conducted in *actual* GSD projects; only one study is based on student teams. Qualitative case study methodology is the most popular research approach applied in these studies. The main issues addressed in this literature include different managerial practices suggested to overcome the

problems imposed by global distribution. Previous research suggested a number of practices that will help to manage and organise globally distributed software development to overcome the challenges discussed in the previous section. A survey of the literature indicated that these practices mainly focus on *cross-cultural collaboration*, aiming to improve collaboration between remote sites, *effective communication*, aiming at facilitating effective communication within globally distributed software development teams, *tools and technologies* that make it possible to collaborate in a distributed mode and *project management* that focuses on the application of the knowledge, skills, tools and techniques required for project activities to meet the globally-developed software project requirements. The following two sections will elaborate on the most important findings and results reported in the literature on GSD projects.

Cross-cultural collaboration in globally distributed software development

Practices for cross-cultural collaboration in globally distributed software development suggested in previous research involves (i) cross-cultural awareness, which aims to ensure cooperation between team members located in different cultural zones, (ii) team building and (iii) trust. These three factors are now discussed.

(i) Cross-cultural awareness

Previous research has identified culture as an important factor that impacts distributed software development (Khan, Niazi & Ahmad 2011, Casey 2010b, Leidner, Kayworth 2006). The full implication of culture can be underlined by the fact that cultural differences between team members have been identified as one of the centripetal forces that have a negative impact on globally distributed software development. Dafoulas and Macaulay (2001) stated that there are several types of culture that shape the behaviour pattern of team members. Some culture types are more dominant than others, determining how an individual works and communicates in a team.

These culture types are:

- National culture that is defined as the “the collective programming of the minds” that differentiates a group of people of a particular country from another country (Hofstede 2003).

- Organisational or corporate culture that helps to establish common values and align the behaviour pattern of employees. It has many facets such as communication style, management style, appraisal and reward system used by the organisation.
- Professional culture that includes culture gained through formal education and training programmes. This culture is reinforced through ongoing professional development and professional activities such as affiliation with associations.
- Functional culture that encompasses the norms and behaviour portrayed by people performing the same functional role in the organisation, such as marketing.

An individual can be a member of multiple cultures such as national culture, organisational culture, professional culture and functional culture. Dafoulas and Macaulay (2001) state that difference in nationality, organisation, profession and the functional role of a team member result in cultural differences in a distributed environment.

Casey (2010b) explained that there is need for team members not only to learn and understand the customs and norms of their remote members, but also to understand their national culture, their religion, their business philosophy and their mindset. Krishna, Sahay and Walsham (2004) identify cultural awareness as a way to reduce the impact of cultural differences in globally distributed software development. According to the authors, cultural awareness involves not only knowing the difference among people of a different culture and country, but also involves knowing one's own culture. By understanding one's own culture, it is easy to compare it with others and it is easier to adjust one's own cultural concepts for it to be compatible with that of the remote team.

(ii) **Team building**

Hart and McLeod (2003) assert that team-building sessions will assist team members to get to know each other better, strengthen working relationships and create team momentum that can enhance team effectiveness. According to Crisp and Jarvenpaa (2015), team building in a distributed work environment helps to enhance trust, which is trust that develops before the team members interact. In a distributed environment, team members do not necessarily need to be located at one location; technology can be used to facilitate this exercise. Pinjani and Palvia (2013) state that one way technology can be used in team-building activities is by using chats and discussion boards.

(iii) **Trust**

Clark, Clark & Crossley (2010) identified that a lack of trust between team members has a negative impact on globally distributed software development. Hence, development of trust between team members in a globally distributed environment is a vital endeavour but it is a quality that is most difficult to develop from a distance. Child (2001) outlines the following principles of trust when discussing trust in a virtual organisation:

1. **Trust needs bonding-** this is relevant to the distributed environment where the three distances identified in the previous section prevent bonding from taking place. Distributed teams need to view themselves as a single team with a common goal to achieve, rather than viewing themselves as an individual unit.
2. **Trust requires keeping in touch-** In Child's (2001) view, personal interaction is important to establish trust. Ba (2001) and Child (2001) assert that trust is likely to develop if frequent and personal interaction and socialisation between team members are facilitated.
3. **Trust is not blind-** Child (2001) asserts that team members need to know each other very well in order to build a sense of trust.

Effective communication in global distributed software development

For communication to be effective in a distributed environment, the following strategies have been suggested:

- Establishing communication protocols that cover ground rules and expectations concerning communication (e.g. for emails) (Oshri, Kotlarsky & Willcocks 2015, Carmel 1999, Sarker, Sahay 2004)
- Investing in language and cultural training (Šmite, Calefato & Wohlin 2015, Battin et al. 2001).

Tools and technology to support global distributed software development

Tools and technologies suggested in the literature to support distributed software development comprise (i) *ICT infrastructure* that allows the transfer of data at high speed, (ii) *collaborative technologies* that enable remote team members to share documents and communicate.

(i) ICT infrastructure

Having the necessary infrastructure and tools to support a multi-country effort is required in a distributed environment (Carmel, Agarwal 2006)

(ii) Collaborative technology

Collaborative technology can be used to enable document sharing and improve collaboration in the globally distributed environment. The most commonly suggested collaborative technologies mentioned in the literature are:

- Email (Sarker, Sahay 2004, Casey 2010a)
- Chat (Instant Messaging) (Herbsleb et al. 2002, Handel, Herbsleb 2002)
- Phone / audio conference (Casey 2008, Handel, Herbsleb 2002)
- Video-conference (Ebert, De Neve 2001)
- Internet/intranet (Herbsleb, Mockus 2003)
- Group calendar (Smith, Blanck 2002)
- Discussion list (Herbsleb et al. 2002)
- Electronic meeting system (Mockus, Fielding & Herbsleb 2002)

Huis and Soekijad (2002) proposed the classification of collaborative technologies shown in table 3. The authors categorise different types of collaborative technology that support different needs of virtual teams in a different time and place.

Table 3: Types of collaboration technology (adopted from (Huis, Soekijad 2002))

	Setting		
	Different place/ different time <i>(off-line), i.e. support between encounters</i>	Different place/ same time (online), <i>i.e. support for electronic encounters</i>	Same place/ same time, <i>i.e. support for face-to-face meetings</i>
Communication Systems <i>aim to make communications between remote people easy, cheap and fast</i>	<ul style="list-style-type: none"> • fax • email • voice-mail • video-mail 	<ul style="list-style-type: none"> • telephone • mobile phone • desktop-video • video/audioconferencing • systems(multipoint) • chat system 	
Information sharing systems <i>aim to make the storage and retrieval of large amounts of information quick, easy, reliable and inexpensive</i>	<ul style="list-style-type: none"> • Document sharing systems • Computer conferencing 	<ul style="list-style-type: none"> • tele-consultation systems • application for searching remote information sources 	<ul style="list-style-type: none"> • Presentation system
Collaboration systems <i>aim to improve teamwork by providing document sharing and co-authoring facilities</i>	<ul style="list-style-type: none"> • co-editing systems 	<ul style="list-style-type: none"> • shared whiteboard • CAD • word-processor • spread-sheets 	<ul style="list-style-type: none"> • Group decision support systems
Coordination systems <i>aim to coordinate distributed teamwork by coordinating work processes</i>	Synchronisers: <ul style="list-style-type: none"> • group calendar • shared project planning • shared workflow system 	<ul style="list-style-type: none"> • awareness/notification Systems (e.g. 'active batch') 	<ul style="list-style-type: none"> • command and control • Centre support systems
Social encounter systems <i>aim to facilitate unintended interactions</i>		<ul style="list-style-type: none"> • media spaces • virtual spaces 	

Project management

The literature suggests that project planning, controlling, and monitoring in a distributed environment should be collaborative and virtual in nature (Murphy, Ledwith 2006). Project management should be built on the foundation of actively involving all team members in planning and controlling the process (Crawford, Pollack 2007). Casey (2010a) suggested the use of collaborative project management tools that offer a project manager a web-based interface to manage project information and allow sharing of calendars and easy milestone tracking. Such project management tools should have a central and shared database that makes current and consistent planning data available to the team members in different locations. This gives the project manager a crucial overview of the project status at different virtual locations.

2.4 Success in information system projects

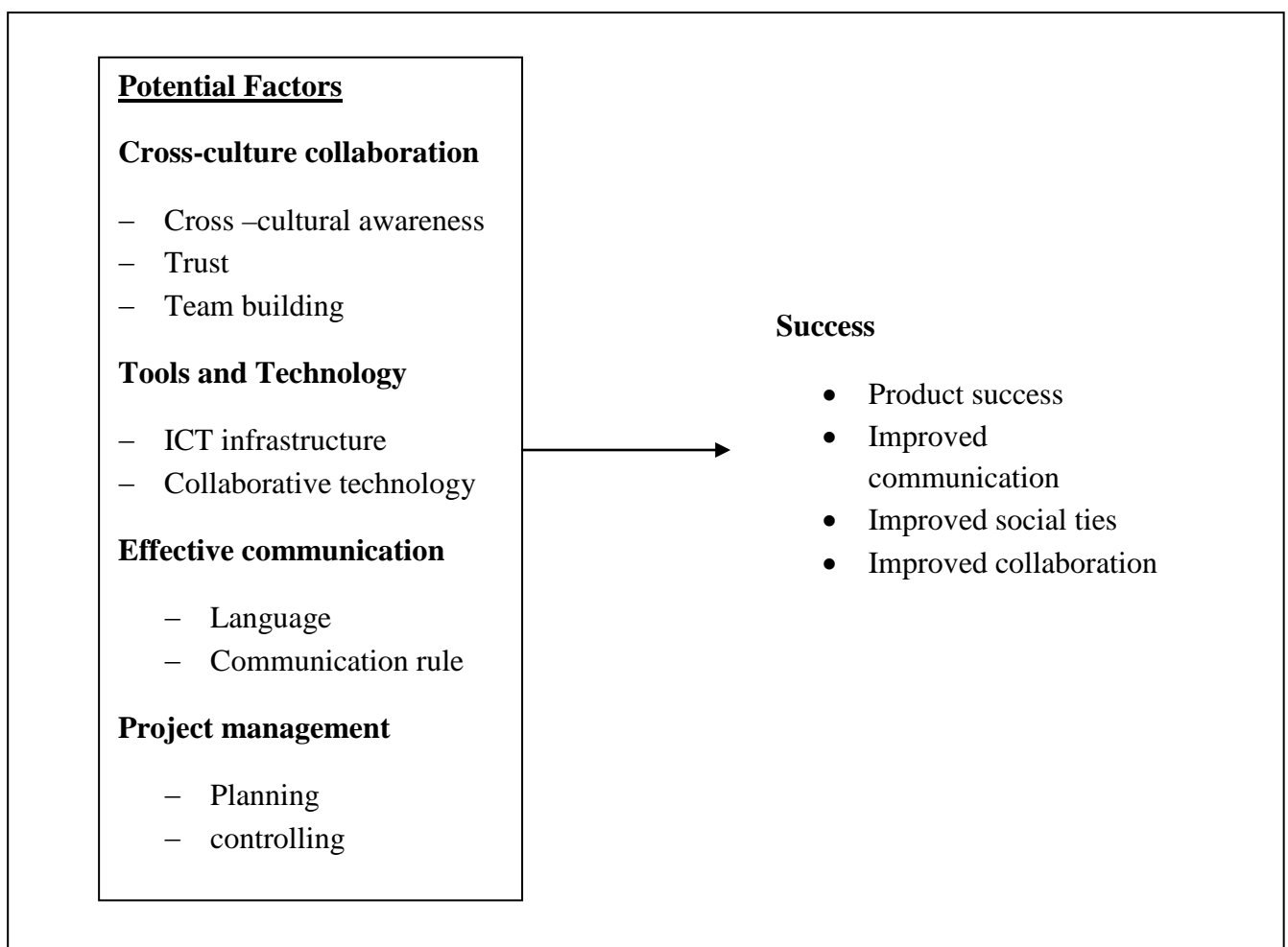
Success in distributed software development projects has been studied from various perspectives. Some researchers place a lot of importance on the project outcome to measure success. Product success can be indicated by an increase in sales, the product being delivered on time and within budget (Andres 2002, Nellore, Balachandra 2001). Product success can be regarded as the attainment of the project objectives. A measure of product success can be objective, where company data can be used to measure success. On the other hand, the measure of success of the product can be subjective, based on people's perceptions of the product success. Other research put more emphasis on the quality of interaction between team members to measure collaboration success, such as social ties, communication and team performance (Hoegl, Gemuenden 2001, Nelson, Coopride 1996). In this sense, success is represented in this research as a combination of product outcomes, people-related outcomes and collaboration process quality.

Success of a globally distributed team can also be a people-related outcome (Hoegl, Gemuenden 2001) which satisfies the psychological needs of the team members (Gallivan, 2001). Hoegl and Gemuenden (2001) identified improved communication and improved collaboration, and increased social ties among team members as some of the examples. This motivated team members to engage in teamwork in the future. In this research product success, improved communication, improved social ties and improved collaboration are used as the indicators of success.

2.5 Conclusion

Despite the fact that research on the management of distributed software development focusing on Middle Eastern software companies is limited, the existing literature recognises the importance of cross-cultural collaboration, tools and technology, effective communication and project management for the success of distributed software development in the Middle East. Figure 3 shows potential factors that might contribute to the success of globally distributed software development in the Middle East.

Figure 3: Potential factors contributing to the success of globally distributed software development



CHAPTER 3: RESEARCH METHODOLOGY

This chapter explains the approach taken to do this research and describes the research process. In section 3.1, the research philosophy and assumptions followed in this study are explained. In section 3.2 we elaborate on the research method and in section 3.3 the research design is explained. In section 3.4 the criteria used to select the cases are explained. In section 3.5 we discuss how data collection was done and in section 3.6 the ethical issues considered in this research are explained. In section 3.7 we provide details regarding the data analysis and in section 3.8 the method used to ensure the trustworthiness of the research is discussed.

3.1 Qualitative research paradigm

This section discusses the research paradigm that was used in this research study. A qualitative interpretive research approach was adopted. Qualitative research places emphasis on attempting to understand and interpret the meaning of situations or events from the perspectives of the people involved and as understood by them (Corbin, Strauss 2014). It is based on textual data rather than numbers. Creswell (2013) defined qualitative research as multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them.

Qualitative research generally follows *inductive theory building*, as theory is developed by interpreting the empirical evidence collected during the study. In inductive theory building, the researcher gathers empirical evidence that will form the basis for developing concepts and theories (Casey, 2008).

Tesch (1991) identifies three common features of qualitative research:

- It is language-oriented and emphasises communication and meaning.
- It is “descriptive /interpretive” in character, providing descriptions and interpretation of social phenomena.
- It includes theory-building approaches that attempt to identify connections between social phenomena.

An interpretive research philosophy implies that “our knowledge of reality is gained only through social constructions such as language, consciousness, shared meaning, documents, tools and other artefacts” (Myers, Newman 2007). This philosophy evaluates the various skills and experiences of individuals in the same context and allows an in-depth analysis of unique situations. Determining how people think and act in specific social and organisational settings is of prime interest in an interpretive approach (Myers, Newman 2007).

Research on globally distributed software development that focuses on software companies in the Middle East is limited. Therefore interpretive research that is closely connected to empirical reality is more appropriate to explore the emerging phenomenon of the management of globally distributed software development in the Middle East. Adopting this method assists the researcher to identify the management practices and success factors that contribute to the success of globally distributed software development in the Middle East. Applying this method will also assist the researcher to gain greater insight into these phenomena through understanding the unique situations that prevail in the Middle East (Myers, Newman 2007).

The motive for using a qualitative approach is linked to the needs of this research. The researcher intends to study people, organisational structure and procedure in a real life context. Adoption of a qualitative approach is required to obtain qualitative data from people in real-life settings (Creswell 2013). The goal of this research is to investigate success factors that contribute to the success of globally distributed software development projects using virtual teams and to construct a management model that can be used to ensure the success of distributed software development projects. As argued by Myers and Newman (2007), qualitative research methods are implemented and designed to help the researcher understand the opinions and views of people and also the social and cultural contexts within which they exist.

Kaplan and Maxwell (1994) argue that the goal of understanding a phenomenon from the perspective of the participants and the particular social and institutional context is largely distorted when textual data is quantified. A qualitative method helps to solicit the views and challenges of software project managers and software developers involved in distributed software development using virtual teams.

3.2 Research Method: Case Study

According to Yin (2013), a research method is a specific research technique which specifies how empirical evidence is collected and analysed in a logical manner. When an appropriate research method is applied, useful empirical data is gathered.

There are a number of methods that an information system researcher can use. Each of these methods has its own strengths and weaknesses (Yin 2013). Gill and Johnson (2010) state “*that no single research method is universally applicable.*” According to Yin (2013), the following factors determine the choice of research method:

- Previous exposure to a particular research method.
- *Good-to-fit* with the research objectives.
- Whether the research is done by one researcher or by a group of researchers.
- The nature of the phenomenon being studied.
- Availability of funds for the research.

Chen and Hirschheim (2004) analysed the research methods used in a number of respected IS journals and noted that the case study research method is rising in popularity. The reason for this is the fact that more and more researchers are engaging in empirical research and are interested in the way in which a phenomenon evolves.

In this study, the strategy that was used for gathering data was case studies. According to Yin (2013), a case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organisations). Yin (2013) describes case study research as particularly suitable for addressing *how* and *why* types of research questions when the researcher has little control over the events. The research pertaining to the management of globally distributed software development satisfied these criteria: it tries to answer the question “*How do companies in the Middle East successfully manage and organise software development in a globally distributed environment?*” in an real-life context. A case study not only covers the phenomenon of interest but also its context, producing large quantities of potential relevant variables (Yin 2013). Therefore, a case study research method was deemed as a good fit for this investigation.

Case study research offers several approaches to data collection and analysis. Yin (2013) identifies several sources of evidence that work well in case study research:

- *Documentation*: Written material ranging from memoranda to newspaper clippings to formal reports.
- *Archival records*: Organisational charts, service, personnel, financial records.
- *Interviews*: These may be open-ended or focused.
- *Direct observation*: Absorbing and noting details, actions, or subtleties of the particular field environment.
- *Physical artefacts*: Devices, outputs, tools.

Evaluation of collected data from different sources increases the validity of the research findings and offers an in-depth analysis of a phenomenon from different angles. A case study research project normally starts with a critical search for existing literature followed by an extensive collection of data methods and a diligent analysis of the evidence, as has been done in this research.

3.3 Research Design

All empirical research has a research design associated with it. Yin (2013) defines research design as “*an action plan for getting from here to there*”. In this research the term *here* is defined as a collection of research questions and *there* as the conclusion reached from analysing the answers to these questions. When constructing the survey, care must be taken to ensure that the research remains focused on its primary goals and objectives. Philliber, Schwab and Sloss (1980) referred to research design as the “blue print” for the research design that covers what questions are to be answered, what data is relevant, what data to collect and how to analyse the findings.

3.3.1 The components of research design

Ritchie et al (2013) identify the following components which need to be addressed when undertaking case study research:

- The questions used in the study.
- Its propositions, if any.
- The unit of analysis.
- Logic that links data to propositions.
- Criteria for interpreting the findings.

In the following subsections, each of these components are discussed.

3.3.2 Development of the research question

The initial step in constructing effective research questions is the identification of the research objective. This has been identified in chapter 1 as follows:

To develop a comprehensive understanding of how to manage globally distributed development projects in the Middle East.

The second step is crafting the research questions by rephrasing and summarising the original research objective identified above. The research question was formally defined as follows (as mentioned in chapter 1):

How can virtual teams be effectively managed in a distributed software development environment?

The research question was expressed in general terms since this acted as a precursor to questions that are more specific. An important factor to consider when developing research questions is the fact that they should be *broad* enough to necessitate the uncovering of knowledge while remaining focused on the research objective. The goal of this research is to identify management practices: methods and techniques that could be used in managing globally distributed software development projects. Factors and variables that affect the successful implementation of globally distributed software development projects in the Middle East were analysed. The following research sub-questions were thus defined:

What factors contribute to the success of globally distributed software projects in the Middle East?

What are the best practices the globally distributed software development teams engage in order to ensure success of the project in the Middle East?

3.3.3 Study propositions.

Yin (2013) states that the second component of case study-based research is the development of study propositions. These propositions help the researcher to focus his/her attention on specific areas. Yin (2013) urged that there might be a valid reason for not developing a proposition before carrying out research when undertaking exploratory case study research. He states that: “At the same time some studies may have a legitimate reason for not having

any propositions.....in which a topic is a subject of ‘exploration’”. Although there are several previous researches on global software development, limited literature exists that focuses on global software development in the Middle East. The propositions will not be developed first in order not to pre-empt the research findings. In this research the phenomenon of GSD in Middle East is studied in-depth following the interpretive tradition: then, as one of the outcomes of this research, propositions about the management practice of GSD are suggested. These propositions can be tested in a positivist manner in future research.

3.3.4 Unit of analysis

Unit of analysis is defined as what the “case” is for a case study. It could be an individual, an event or an entity that is less well-defined than a single individual. Creswell (2013) characterises a case study as an entity or phenomenon bound by time and activity, an entity which can be based on either individual or group activities. According to Creswell (2013), a case can be defined as a “*single site or location of a development team if that development was distributed across several locations*” in the context of global software development. In this study, the project, distributed between at least two locations will be taken as the unit of analysis. The reason for this is to allow the researcher to have access to a broader range of data rather than to collect data from a single team. Also, it allows data to be collected without being limited to the current assigned location of the interviewee to grant a more holistic overview of each organisation.

3.3.5 Logic that links data to propositions

The fourth component of case study research design is to connect data to propositions. This linkage is done after the data collection phase, as themes emerge. As data is analysed, the researcher attempts to match patterns that appear in the data to the theoretical propositions of the case study. The themes that emerged in this study thus served as answers to the research questions identified in chapter 1.

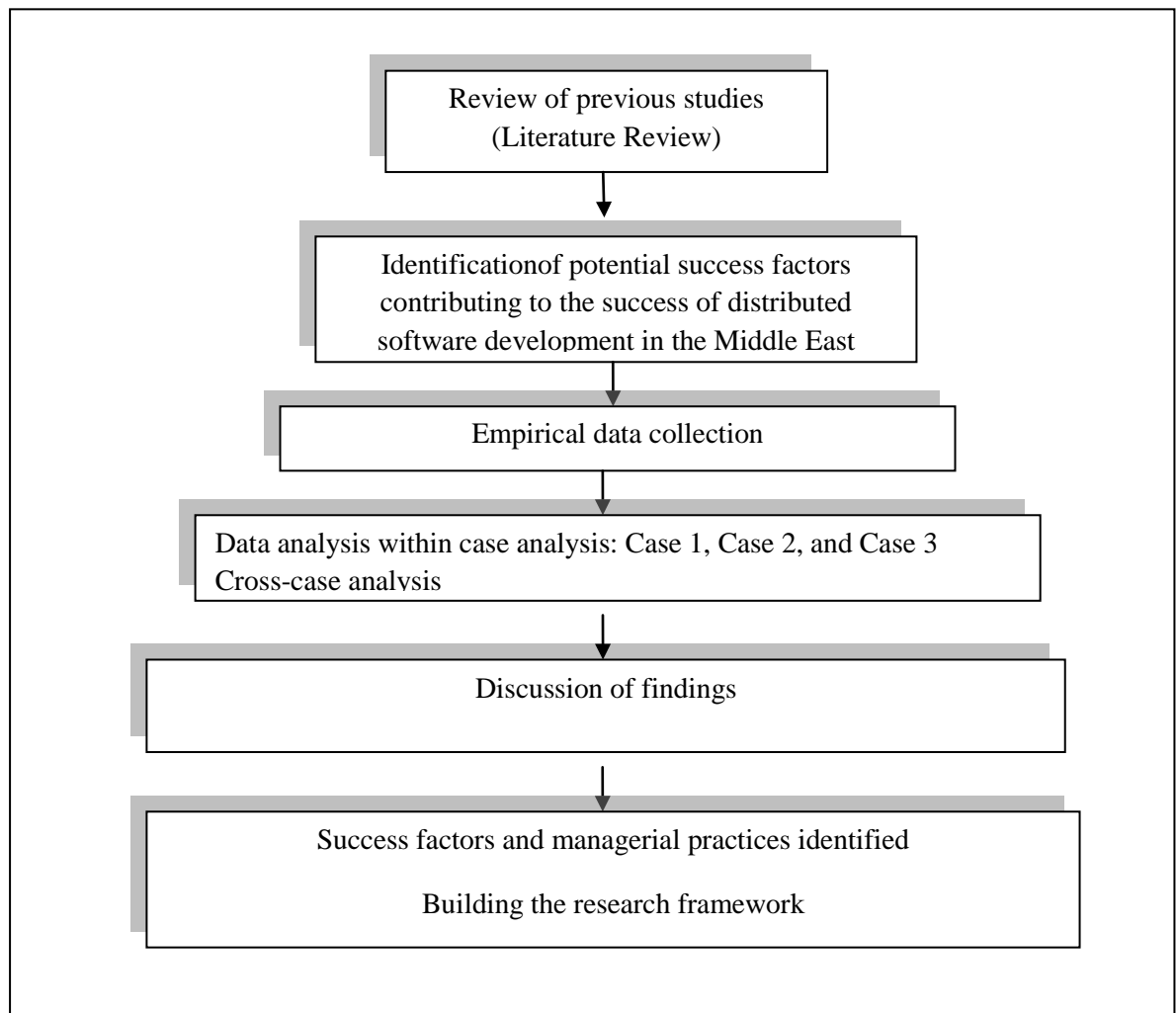
3.3.6 Criteria for interpreting findings

The last component of case study research design is the criteria for interpreting the findings. Commonly, the case study researcher codes the data prior to developing themes (Yin, 2013). Following the theme development stage, we needed to carefully extract meaning from the findings to determine recommendations for practice and future research.

3.3.7 Overview of the research process

Figure 4 gives an overview of the way in which the study was conducted. The investigation was divided into different phases and the research process occurred at different times.

Figure 4: Procedural step of the study



3.4 Selection of the cases

According to Yin (2013), the selection of the cases for the study is largely determined by the research questions which in turn determine what data needs to be collected. A *multiple case study* was used in this research. This allowed the researcher to compare and contrast data from different cases, thereby increasing the validity of the research. The researcher focused on three software development companies that operate in the Middle East. These are referred to as case 1, 2, and 3 respectively in this study (company names were not mentioned so as to

protect privacy). Most of the projects these companies have been involved with were developed using virtual teams. The selection criteria for these cases were based on the fact that all the companies selected have a strong software development presence in the Middle East and that the companies are multi-national, undertaking software projects distributed in at least two locations. The companies selected had implemented and developed a number of successful offshore development projects, both in the private and public sector. The staff employed by all three companies had extensive experience in the implementation of both co-sited and globally distributed software development projects. The choice of companies which could be studied was limited for a number of reasons. Firstly, not many companies had employees that can speak and understand English. Secondly, very few companies readily gave access to an external researcher. Therefore only three companies complied with the above-mentioned criteria.

3.5 Data Collection

Yin (2013) describes three principles for data collection in order to achieve the objectives of validity and reliability:

- Use multiple sources of evidence.
- Create a case study database.
- Maintain a chain of evidence.

The researcher used direct observations, document reviews, group discussions and interviews to gather data from diverse sources. This is in line with the principle of multiple sources of evidence. A database was created to manage data for these case studies. This database provided an interface that allowed data and analysis to be linked and presented in a layout that was easy to interpret. A reliable chain of evidence was maintained.

3.5.1 Direct observation

The companies selected for the case studies agreed to allow the researcher to observe the team operations and meetings (phone and video conferences) and other communication between sites. The researcher also observed the working environment and team atmosphere at local offices. The main aim of observation was to collect relevant evidence for analysis. Document and infrastructural reviews were included in this process. Process documentation was extensively analysed and reviewed. This included artefacts created for coordinating

various projects. The infrastructural review was carried out in order to gather data about communication tools used, as well as technological tools used to support virtual teams involved in development projects in distributed software development environments. The infrastructure used was identified, as well as the way in which it was utilised. This was followed by the selection of interview participants.

3.5.2 Interviews

The main source of data in this research was semi-structured interviews. The researcher needed to develop a generic interview guide that contains a list of themes and questions to be covered. This method was selected in order to obtain highly personalised data. An interview also allowed the researcher to probe for more information. Probing allowed the interviewer to explore new areas that were not initially considered. In a semi-structured interview the researcher does not need to adhere to a detailed interview guide (Kajornboon 2004), hence the researcher was able to rephrase and simplify a particular question if the interviewee did not understand what was asked.

Project managers, development managers, quality assurance managers, operations managers, team leaders and site managers who were responsible for implementing globally developed software projects were involved in the interviews. The interview questions linked the data to be gathered, the conclusions to be drawn and the research questions of the investigation (Yin, 2013).

There are possible challenges associated with interviews and the researcher was aware of them. The researcher took into account the following pitfalls associated with interviews (Myers, Newman 2007).

- *Lack of trust.* The interviewer is a stranger. The interviewee is concerned with how much information to release, and to what extent the interviewer can be trusted.
- *Lack of time.* Lack of time for interviews may result in incomplete data gathering.
- *Elite bias.* The interviewer may be able to interview only senior managers and may fail to get a broad understanding of the operational details.
- *Hawthorne effects.* The interviewer may interrupt and potentially interfere with participant behaviour.
- *Ambiguity of language.* The meanings of words are often ambiguous and the subjects may not fully understand the questions.

- *Interviews can go wrong.* The interviewer can unintentionally offend the interviewee and the interview might be terminated prematurely.

To account for some of these pitfalls, preparations for the interviews required extensive groundwork to be done. Appropriate interview venues, dates and times needed to be organised in advance, depending on the company under investigation. The communication with interviewees was done through e-mail, telephone and direct contact. The interviewees were requested to obtain a written approval to participate in the interviews from the management before they attended the interviews. The interview sessions were spaced and spread over a period of time to allow time for the correction of errors and to avoid any unexpected pitfalls.

3.5.2.1 Development of the semi-structured interview guide

A generic interview guide (Appendix D) was prepared for the semi-structured interviews. This interview guide contained informal groupings of topics and questions that were going to be asked. An interview guide must be flexible and broad enough to cover the roles and experiences of respondents. Yin (2013) confirms that “*interview guides help researchers to focus an interview on the topics at hand without constraining them to a particular format*”. This gave the interviewer the freedom to customise the questions for a specific interview context/situation, and for the people that are being interviewed.

3.5.2.2 Recording of the interview

Two methods of recording the interview were used, namely electronic recording and handwritten notes. Permission to record the interview electronically was requested from respondents. A respondent might not be comfortable with having the conversation recorded electronically, especially junior staff. On the other hand, writing notes slowed the process down and resulted in the interviewer not being able to record all the deliberations that took place.

It was not easy to determine to what the extent the electronic recording of the deliberation constrained the responses of the participants.

3.5.2.3 Selection of the interview participants

Ten people from each company were interviewed based on availability and that they had to meet the criteria that the participant needed to have at least one year experience in global distributed software development environment. A total of 30 interviews were conducted during the course of the study. The management of the different companies selected the individuals to be interviewed. The persons to be interviewed were project managers, development managers, systems analysts, quality assurance managers, operations managers, team leaders and site managers.

Each participant was interviewed for a period of one hour. The chance to have a face-to-face interview with virtual team members based in India, Pakistan and the USA would have been helpful but due to time constraints and limited financial resources it was not possible. However, a telephone interview were conducted wherever possible.

3.6 Ethical considerations

The School of Computing at the University of South Africa (UNISA) is very particular about ethical issues. The researcher therefore took all the necessary precautions to ensure maximum confidentiality. As argued by Walsham (2006), the researcher needs to offer anonymity to all interviewees. The individuals interviewed were not identified by their names or specific positions in reports or publications. The names of companies and organisations participating in the research were not be published; instead codes such as case 1, case 2, and case 3 are used.

In addition, the researcher acted in a way which did not harm the participants or infringe on their privacy. The researcher was explicit about the aim of the research and did not deceive the participants. The research was conducted with due consent of participants. There is a fine line to be trodden on the issues mentioned above (Walsham 2006). However, the researcher took all the required precautions to ensure that these issues are taken into account.

To comply with UNISA regulations, an ethics form was submitted to the Ethics Research Committee of the institution. To ensure that participants were fully aware of the research in which they were participating, an interview consent form was made available to them. Participation in the investigation was voluntary and no participant was forced to divulge information unwillingly. Data to be collected were not be shared with third parties. The final

dissertation to be presented to the department was, however not confidential. The names of participating individuals and organisations remained anonymous.

3.7 Data analysis

This investigation used a descriptive and qualitative method to analyse the collected data (Thomas 2006). The primary purpose of using this approach was to allow the investigation findings to emerge from the recurrent, leading themes inherent in the raw data (Corbin, Strauss 2014, Glaser, Strauss 2009, Walsh et al. 2015). According to Thomas (2006), this process is achieved by:

- Condensing raw text data into a brief, summarised format.
- Establishing a clear link between the research objectives and the summary findings derived from the raw data and ensuring that links are both transparent (able to be demonstrated to others) and defensible (justifiable given the objectives of the research).
- Developing a model or framework based on the underlying structure of experiences or processes that are evident in the text (raw data).

The assumptions underlying a general inductive approach are as follows (Thomas 2006):

- The data analysis is largely based on both the research objectives and multiple readings and interpretation of the raw data. Thus, the findings are derived from both the research objectives outlined by the researcher and findings arising directly from the analysis of the raw data.
- The primary mode of analysis is the establishment of major categories from the raw data into a framework that shows similar themes and processes that are regarded as vital by the researcher.
- The researcher codes the data and makes various interpretations from the raw data. The research findings are based on these interpretations. The experiences and assumptions of the researcher largely shape the research findings. In order for the findings to be usable, the researcher needs to make decisions about data that is more important and remove data that has little to contribute to the overall research.
- Different researchers are likely to produce different findings.

- Different techniques can be employed to assess the *validity* of the findings such as comparison with findings from previous research, triangulation within a project, as well as feedback from participants in the research.

3.7.1 The process of coding

The following procedures were used for coding and analysing the qualitative data (Thomas 2006):

- *Preparation of raw data files (data cleaning)*. The first stage was to format data files into a common format. Each raw data file needed to be backed up.
- *Close reading of text*. The researcher read the data several times to gain an understanding of the themes.
- *Creation of categories*. The researcher parsed the raw data, identifying and defining categories and themes.
- *Overlapping coding and uncoded text*. The researcher checked segments of text coded in more than one category and texts not assigned to any category.
- *Continuing revision and refinement of category system*. The researcher searched for contradictory views and new insights.

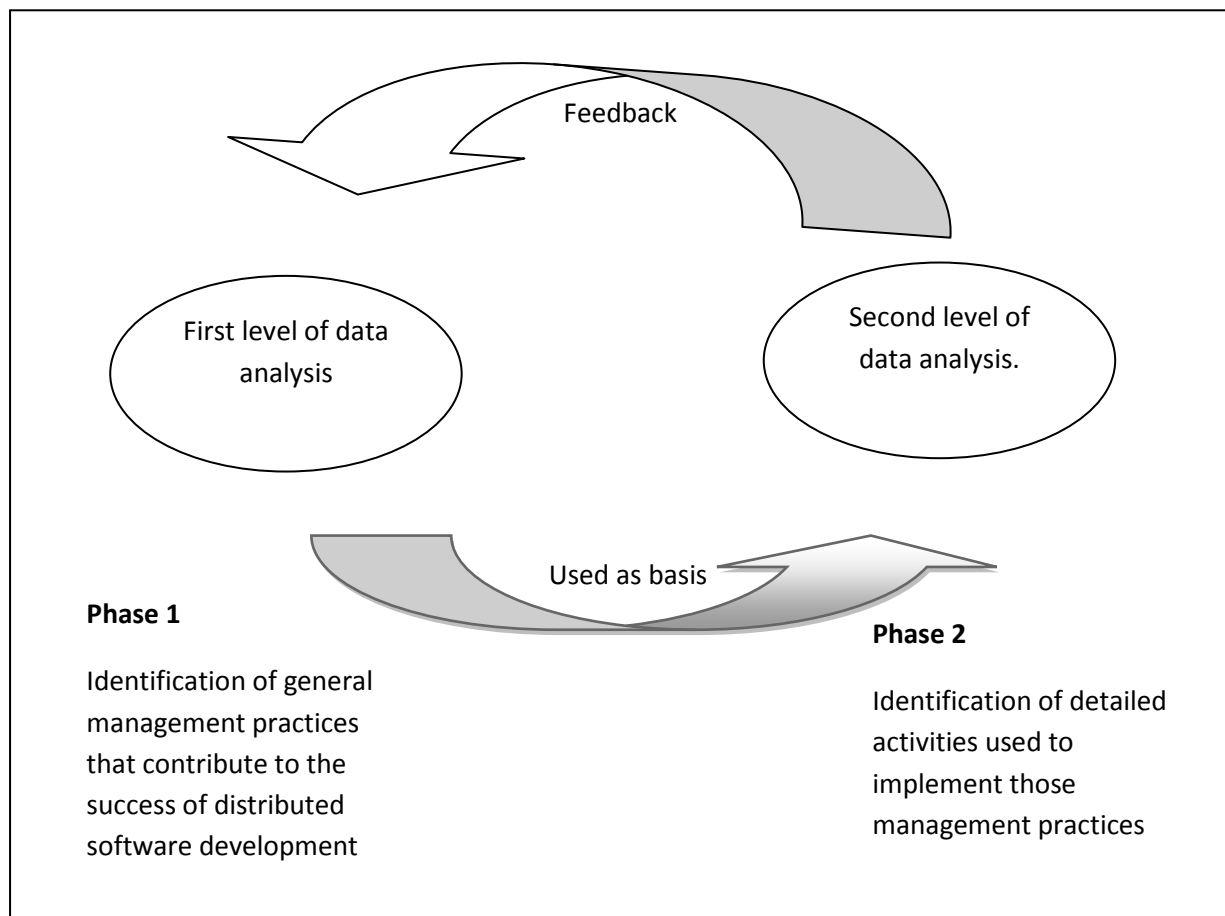
The data analysis was carried out in two phases: within-case analysis and cross-case analysis. This is described in the next section.

3.7.2 Within-case analysis

The data analysis was guided by the research question: *How do companies in the Middle East successfully manage and organise software development in a globally distributed environment?*

This involved identifying management practices perceived to be useful for managing distributed software development using virtual teams. This was done during the first level of data analysis. The second step was to identify detailed activities used to implement identified management practices. The diagram in figure 5 illustrates the two stages of data analysis.

Figure 5: Data analysis within case (Kotlarsky, Oshri 2005)

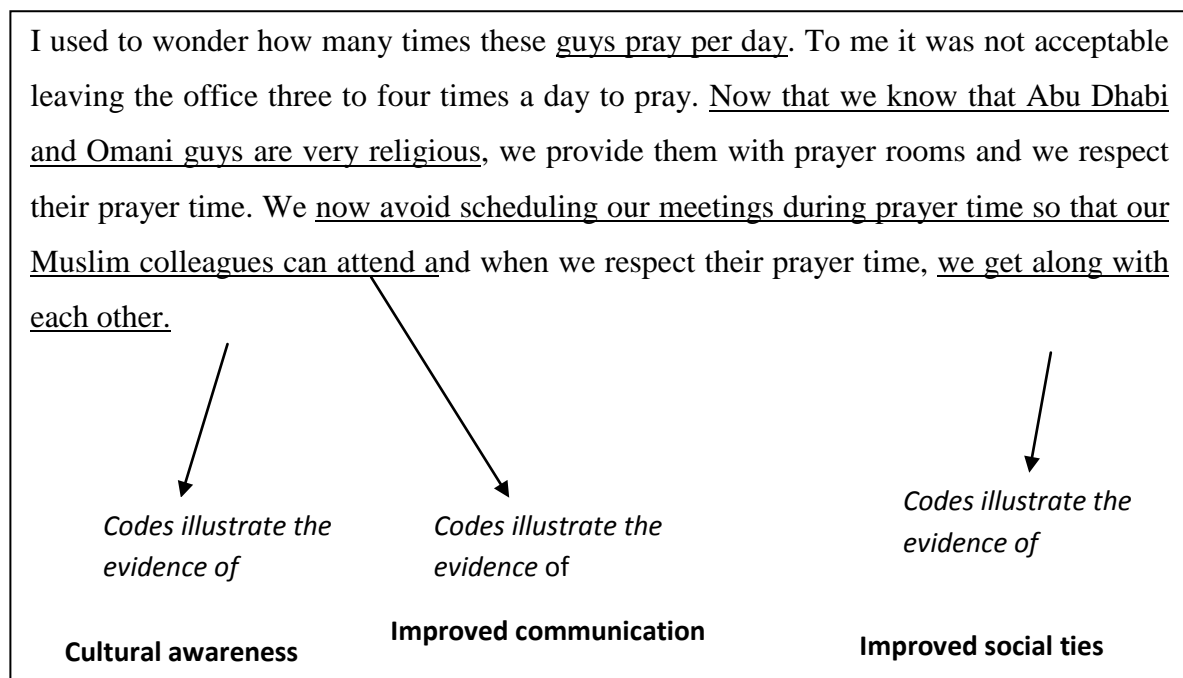


Phase 1: Identification of general management practices that contribute to the success of distributed software development

The interview transcripts and documents gathered needed to be read several times to check for multiple meanings in the text. The transcripts were read independently of each other. During the process of reading texts, the text describing management practices were coded using an open-coding technique (Corbin, Strauss 2014). Example 1 illustrates how the coding was done, based on a statement from an interview.

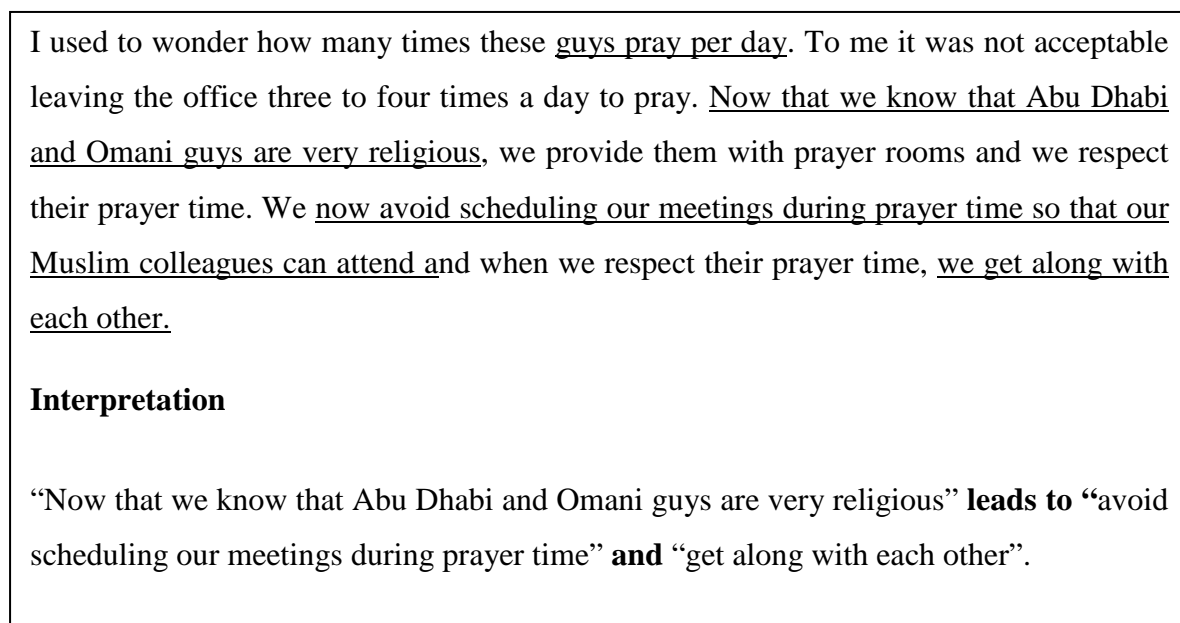
As example 1 shows, the above phrase "we know that Abu Dhabi and Omani guys are very religious" illustrates the concept of cultural awareness (cross-cultural collaboration): therefore, following the open-coding technique, they were marked as codes. Likewise, the phrases "*now we avoid scheduling our meetings during prayer time so that our Muslim colleagues can attend*" and "*we get along with each other*" illustrate success (improved communication and improved social ties, respectively) therefore they were marked as codes.

Example 1: Example of codes



Activities pointed out by interviewees as having an impact on the success of distributed software development were linked to appropriate success factors by creating relationships between appropriate codes. Relationships identified, are of types starting with “therefore”, “lead to” and “in order to”. This is illustrated in example 2 that shows how relationships were established.

Example 2: Establishing relationships

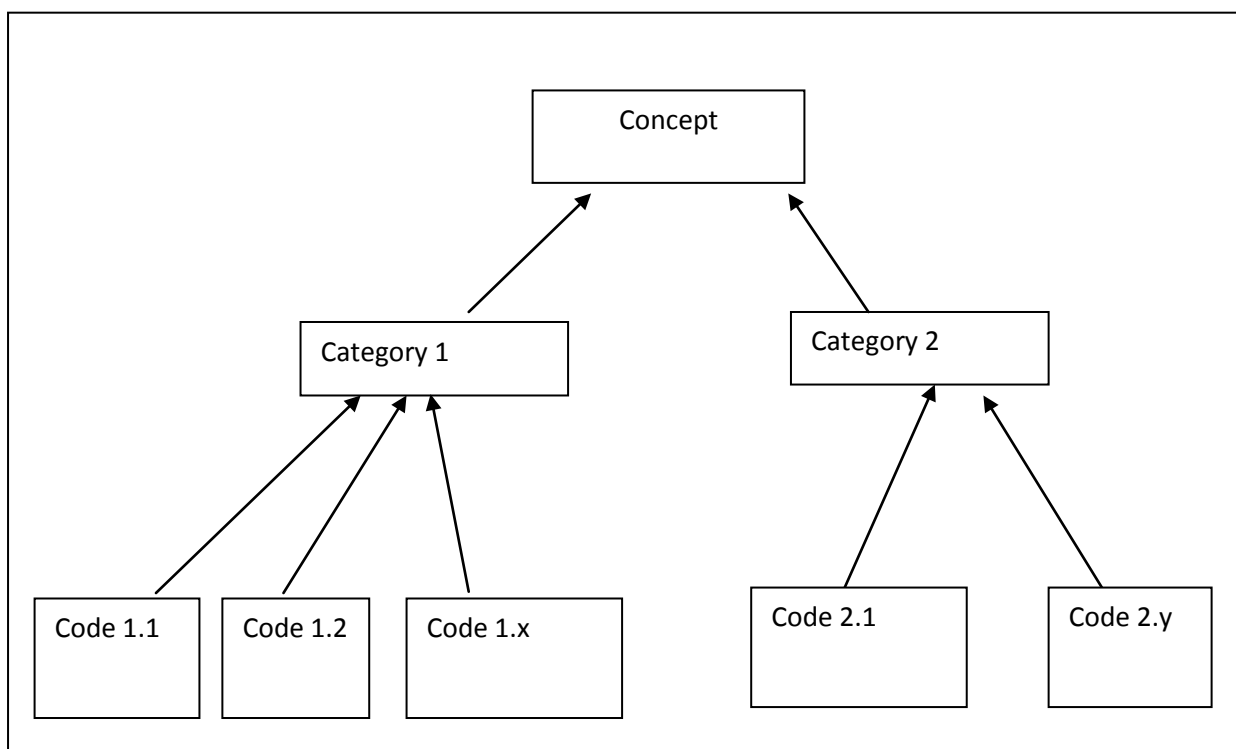


The above statement was interpreted as “*we know that Abu Dhabi and Omani guys are very religious*” leading to “*avoid scheduling our meetings during prayer time*” and “*get along with each other*”. The code “*cultural awareness*” was linked to codes “*avoid scheduling our meetings during prayer time*” and “*get along with each other*”.

The second step was to identify main categories from empirical data. This was be done by grouping codes sharing similar concepts into a higher concept. This categorisation allowed the researcher to remain with fewer units and also allowed the main theme to emerge from the data. The figure 6 below represents the process used to associate code with categories.

The codes represent the management practices that were extracted from transcripts and documents. These codes are categorised into broader themes referred to as categories. The categories are further grouped into concepts. The concepts represent the management practices that are used as the basis for finding detailed activities.

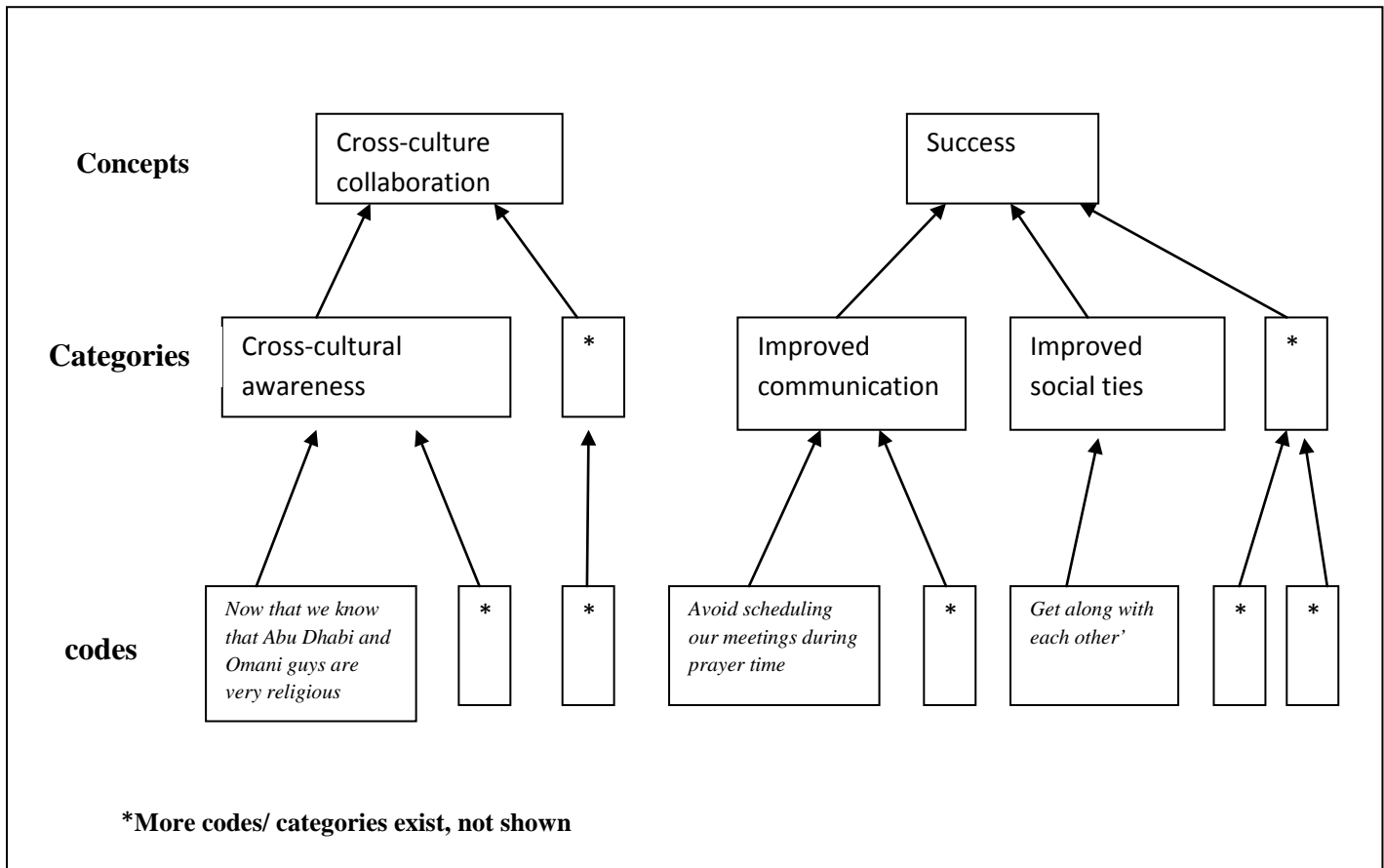
Figure 6: Data linking Strategy (Kotlarsky, Oshri 2005)



For example, *cross-culture collaboration* concept: *cross cultural awareness* is one of the categories that represents the concept *cross-culture collaboration*-Now that we know that *Abu Dhabi and Omani guys are very religious* is one the of codes that represents the category *cross cultural awareness*.

Example 3 illustrates the data sorting and linking approach described in figure 6 (the example is based on the interview statement used in examples 1 and 2).

Figure 7: Example 3 Sorting of the data



Phase 2: Identification of detailed activities used to implement those management practices

This phase involves scrutinising the data with the aim to identify specific activities that enable the implementation of the management practices identified in phase 1. Those were coded. The relationship between specific activities and associated management practises were established.

3.7.3 Cross case data analysis

Findings from different cases were compared to find similarities and differences. The comparison was done by listing the similarities and the difference between cases.

3.8 Trustworthiness of the empirical research

Guba (1981) in his first publication, proposed credibility as one of the criteria to ensure that the qualitative research is trustworthy. Lincoln and Guba(1985) argue that ensuring credibility is one of most important factors in establishing trustworthiness. Credibility is defined as the confidence that can be placed in the truth of the research findings (Macnee, McCabe 2008, Holloway, Wheeler 2002). The following provisions may be made by researchers to promote confidence that they have accurately recorded the phenomena under scrutiny:

- a) *Data triangulation* was used to ensure trustworthiness of the research. Evidence was gathered from a number of sources “*aimed at corroborating the same fact or phenomenon*” (Yin 2013) and not “*when you have multiple sources that nevertheless address different facts*” (Yin 2013). Collecting evidence from a number of sources provided a number of *measures* of the same phenomenon (Yin 2013) and ensures authentication of constructs and hypotheses (Ritchie et al. 2013). The researcher also had the case study report reviewed by the key informants (Yin 2013). The participant feedback was included in the final case report.
- b) *Tactics to help ensure honesty in informants when contributing data of individuals* to serve as informants. Each participant was given the opportunity to refuse to participate in the interview so as to ensure that the data collection sessions involved only those who were genuinely willing to take part and prepared to offer data freely. Participants were encouraged to be open right from the outset of each session, with the researcher aiming to establish a rapport in the opening moments and indicating that there were no right answers to the questions that will be asked. The researcher stressed that no confidential information were going to be published. Participants could, therefore, contribute ideas and talk of their experiences without fear of losing credibility in the eyes of managers of the organisation. The researcher explained and made it clear to participants that they had the right to withdraw from the study at any point without giving any explanation to the researcher.
- c) *Iterative questioning*. This strategy was employed to uncover deliberate lies. The technique used included the use of probes to elicit detailed data and iterative questioning, in

which the researcher returned to matters previously raised by an informant and extracted related data through rephrased questions. In both cases, where contradictions emerge, falsehoods could be detected and the researcher decided to discard the suspect data.

3.9 Conclusion

This chapter included an outline of the research methodology that was followed. Reasons for choosing a qualitative case study methodology were provided, and the case selection criteria were explained. The research design and process, as well as the techniques used for data collection and analysis were elaborated upon and explained. In the next chapter the findings from all cases are presented.

CHAPTER 4: FINDINGS AND DISCUSSIONS

This chapter presents the findings from the three case studies. The chapter begins by presenting the background information of the three case studies in section 4.1. Section 4.2 presents the success factors and managerial practices that were viewed by participants from the three case studies as important to the success of a globally distributed software project in the Middle East. Detailed descriptions of each case study can be found in Appendices A, B and C. The chapter concludes with a summary of all the findings from the researched case studies.

4.1 Similarities and differences between the studied cases

In many ways the studied projects are similar. All three cases (cases 1, 2 and 3) comply with the criteria that guided the case study selection:

- All three cases should be operating in the Middle East.
- The development team should be globally distributed between at least two locations.
- The development team members should have extensive experience in the implementation of both co-sited and globally distributed software development projects.

There are, however, some differences between the three case studies. Those differences are mainly contextual, such as different cultural backgrounds of the team members, different countries, the number of years experience of the remote teams and different time-zones. Table 4 summarises the similarities and differences between the studied cases.

Table 4: Similarities and differences between the studied cases

	Case 1	Case 2	Case 3
Countries involved in the development	India, Oman and Abu Dhabi	India, Pakistan and Oman	Dubai and the USA
Culture	Indians, Omanis and Emiratis	Indians, Pakistanis and Omanis	Americans, and Emiratis
Time zone difference	1½ hours' time difference between India and Oman. Oman and Abu Dhabi are in the same time zone.	1 hour between Pakistan and Oman. ½ hour between India and Pakistan.	8 hours' time difference between Dubai and the USA
Size of the development team	10	12	15
Number of development teams	3	3	2
Project type	New product development	New product development	New product development
Previous experience of collaboration between development teams	5 years	15 years	14 years
Project duration	6 months	10 months	8 months

4.2 Data Collected

The analysis and results of all the cases are presented and discussed in this section. The managerial practices viewed as vital are presented first. In section 4.2.2 we present evidence collected in interviews about the success achieved in the studied cases. These are discussed and illustrated by empirical evidence from the interviews. It should be noted that we use 'he' to refer to team members that could be male or female throughout this dissertation.

Data collected in all the cases was analysed following the methodology described in chapter 3. The data gathered was examined in order to identify as many concepts as possible. Concepts that were related, were regrouped into categories. The reason for this was to identify a reasonable number of concepts that we could work with, as well as to achieve a

proper level of abstraction. In all three cases, a total of 14 factors were perceived as important for the success of global software development. During data analysis, the concepts were classified into 4 high-level categories that focus on different aspects of project management. Those groups were identified as follows:

- **Cross-culture collaboration:** This focuses on the activities that facilitate cooperation and group effort of software teams at different sites.
- **Effective communication:** This describes practices that facilitate effective communication within globally distributed software development teams.
- **Collaborative tools and technology:** This describes tools and technologies that are necessary in globally distributed software development environments.
- **Project management:** This focuses on the application of knowledge, skills, tools and techniques required for project activities to meet globally developed software project requirements.

Most of the factors were identified in all three cases, but some factors were identified in two out of the three cases. The concept of communication rules was unique to case 3. Table 5 lists the factors and shows each factor in those cases where it was identified (denoted by +). The factors that were lacking in some cases but considered as important by interviewees, are shown by ‘-/ needed’. Empty cells in the table indicate we did not find evidence to support whether those factors were in place or lacking.

Table 5: Success factors and managerial practices: comparison of results across cases

Success factors and managerial practices	Case 1	Case 2	Case 3
A) Cross-culture collaboration			
1. Cultural awareness	+	+	-/needed
2. Team building	+	+	-/needed
3. Trust	+	+	+
4. Facilitate socialization	+	+	
B) Effective communication			
5. Communication plan	+	+	+
6. Communication rules	+		
7. Language	+	+	+
C) Tools and technology			
8. ICT infrastructure	+	+	+
9. Cloud-based development tools	+	+	
10. Collaborative tools	+	+	+
D) Project management			
11. Planning	+	+	+
12. Control	+	+	+
13. Developing project objectives and success measures	+	+	+
14. Involving the whole team in planning	+	+	+

4.2.1 Success factors: Description and Evidence

In this section, managerial practices perceived by interviewees as important for success in a global software development environment are described and illustrated using statements made by interviewees.

4.2.1.1 Cross- culture collaboration

The following are the managerial practices and success factors identified under cross-culture collaboration:

Cultural awareness

Global software development requires cooperation and collaboration of remote teams located in different cultural zones. Their operation is greatly impacted on by cultural differences among remote teams. Evidence that emerged from all three case studies indicated that management was aware of the implication of cultural differences and its impact on the operation of its software teams. However, it was only in cases 1 and 2 where practices that increase cultural awareness were implemented. The evidence gathered from all three cases suggests that increasing global cultural awareness and developing a global mind-set, helps to provide a conducive work atmosphere in which virtual teams view themselves as a part of the global team. In case 1, for example, one project manager based in Abu Dhabi explained: *“We want everyone here to be aware of the Hindu culture, and everyone in India to be aware of the Muslim culture. Our aim is to develop one culture that is acceptable to everyone.”*

It also emerged that creating a cultural awareness among team members helps team members to develop cultural tolerance and also helps them to view cultural differences as an opportunity to learn about other cultures. Communication across national boundaries will be easier if team members are aware of differences in native languages, beliefs, religion and values. The interviewees in cases 1 and 2 acknowledged that if team members are aware of each other’s national culture and values, it will help them to understand and interpret the behaviour of the remote team members. We observed that increasing cultural awareness reduces cultural clashes and avoids communication breakdown. This was explained by the following statement from one of the interviewees in case 1: *“I used to wonder how many times these guys pray per day. To me it was not acceptable leaving the office three to four times a day to pray. Now that we know that Abu Dhabi and Oman guys are very religious, we provide them with prayer rooms.”*

In one instance in case 1, the Indian project manager who was attached to Abu Dhabi acknowledged that there used to be problems when all the developers asked permission several times per day to leave the office to go and pray in the mosque. When the Indian project manager refused to give the developers permission to go and pray, they decided to report the manager to the government. This resulted in the government threatening to withdraw the work visa of the project manager.

Cultural awareness was also linked to communication breakdown by several respondents in all three cases when they acknowledged that cultural awareness avoids communication breakdown. This was explained by a respondent in case 2 when he said: *“We now avoid scheduling our meetings during prayer time so that our Muslim colleagues can attend.”*

“Our guys here [India] discovered that the majority of the guys in Oman and Pakistan are Muslim and that they need to pray at certain times. We now know their prayer times and we avoid calling them during that time.”

It was observed that most of the Muslim developers based in Oman, Pakistan, Dubai and Abu Dhabi would not attend a meeting if it was scheduled during prayer time.

In case 3 it emerged that there was no interchange of information pertaining to public holidays between sites. This negatively affected cross-site communication. During the interview phase it became clear that the USA-based teams were not informed when the teams based in the Middle East celebrated national public holidays. We further investigated this issue with the teams based in the Middle East and it emerged that religious holidays are dependent on analysing the moon phases. One respondent explained this as follows: *“Most religious holidays are determined by the Hijri calendar and the moon. The holiday cannot be declared until the new moon has been spotted by the Moon Sighting Committee.”*

The teams based in the USA stated that a lack of information about public holidays negatively affected the team operation. If team members are aware that their remote colleagues will be out of the office, they would raise urgent issues earlier. One interviewee based in the USA explained as follows: *“It’s so frustrating to try to contact a remote member on urgent issues, only to be told that he or she is on a public religious holiday. It’s so demotivating. It will be nice if they can inform us.”*

The majority of interviewees acknowledged that there are certain characteristics that differentiate one culture from another, and they also acknowledged that there is certain

behaviour that is accepted in one culture but not acceptable in another. If team members have no knowledge of each other's culture, this will have a negative impact on their working relationship. This was evident from one experience in case 1 when the company decided to organise a social gathering where the team members from India, Oman and Abu Dhabi were invited to a local hotel. The majority of the members based in Oman and Abu Dhabi did not attend the social gathering mainly because alcohol was served. Alcohol in the Islamic religion is considered as "*aram*" (unlawful). One respondent in case 1 based in Oman quoted the Qur'an, Surah 5, to explain why Muslims do not attend social gatherings where alcohol is served. He said the following: "*Oh you who believe! Intoxicants, gambling, are an abomination of Shaytan's (Satan's) handiwork. So avoid that in order for you to be successful.*" For this reason the majority of the members based in Oman and Abu Dhabi did not attend the social gathering.

When asked how they increase cultural awareness, the project managers in cases 1 and 2 pointed out that everyone in their team had been temporarily assigned to a remote location. This was made possible mainly because of relatively inexpensive travelling costs between India, Pakistan, Abu Dhabi and Oman. This interchange of human resources between sites helps members of remote teams to develop relationships. Such visits help to transform problems caused by cultural diversity into strengths. This was in line with what other researchers have recommended as the most effective way of cultural interchange between remote teams. When recruiting new employees as part of the organisation's induction policy, new recruits undergo cultural training. Such orientation courses also help new team members to develop a cultural understanding of their remote team members which will in turn avoid possible cultural clashes in the future.

In case 3 there were no measures implemented to address cultural diversity. It was not practically possible for the remote teams to visit each other because of the distance between the USA and Dubai. Through a telephonic interview the team based in the USA expressed their need for appropriate cultural training. This was also echoed by the team based in Dubai when one respondent said: "*Cultural training is needed.*" They also expressed the need to have one team member based in the USA attached to Dubai and one team member from Dubai to be attached to the USA. This allows cultural interchange between the two teams.

Team building

Cooperation between distributed team members is important for global software development to be successful. The geographical separation of team members at remote sites can hinder effective cooperation and collaboration between the teams which results in a need for team building. We discovered that team building is challenging in the Middle East due to salary and position inequalities that are based on gender, race and nationality of passport. Male nationals always rate highest on the positional scales than the female nationals. The Western expatriates are rewarded higher salaries than other nationals.

Team building is important in globally distributed software development environments because it helps each member of a team to have shared goals, visions and values and to be aware of the existence of the other team. The empirical evidence that was gathered indicates that team members may not feel committed to their team if they work virtually. Interviewees suggested that team members need to know that they are contributing true value to the goals of the team and to the vision of the organisation as a whole. They also need to be aware that they play a very important role in the success of the team in achieving its goal. When explaining this, a senior software developer in case 2 said: *“Everyone, including the lowest person in the organisation, needs to know that his effort is valued by the organisation.”*

Team building was cited as a way to reduce the challenges of cultural clashes, communication breakdown and to increase team cohesion in both cases 1 and 2. Interviewees indicated that through team building exercises, they were able to realise the importance of working as a team. One participant in case 1 explained the following: *“Team building exercises help us to uncover the simple truth that we cannot achieve anything as individuals. Hence we need to interact and collaborate with other members. It also helps us to build personal relationships.”*

As illustrated by the quotes given above, team building helps team members to understand the importance of communicating and engaging with each other to achieve team goals. Such realisation helps team members to improve communication skills despite the distance that separates them.

When asked what they are doing to build team spirit, the project manager pointed out various ways summarised below:

Create a team charter: The process of creating a team charter was mentioned by the interviewees as a team building exercise. One respondent pointed out that the process of creating a team charter allows a team member to explain his or her views on what the main purpose and objectives of the team are, thus making it clear where time and energy should be directed. He also explained that for a team charter to be effective in a team building exercise, it needs to be a collective effort when he said: *“Everyone needs to be involved regardless of which site the team member resides at.”* Once the team members truly understand the main purpose of the project, they can establish goals and timelines to assure that those can be achieved. This in turn will serve to minimise unproductive conflicts within the team, give individuals a sense of purpose and allow the project manager to provide appropriate coaching and feedback along the way.

Acknowledgement of team effort: The majority of the interviewees mentioned the importance of acknowledging team effort, especially when they achieve a major milestone in the project. One respondent emphasised the need for acknowledging team effort when he said: *“Team members may leave if their effort is not recognised. If management appreciates our work, we feel motivated.”*

Interviewees revealed that top management in cases 1 and 2 provides timely acknowledgement of team effort. They hold a virtual monthly progress meeting with all the distributed members and it is in these meetings that management announces the team that achieved a major milestone. Team recognition contributes greatly to team building and informs the team that, together, they are important to the organisation.

To be effective, team recognition needs to be truthful and honest and should not be done merely out of duty. It emerged from the data analysis that for the acknowledgement of accomplishments to be effective, it must be done timeously. The interviewees stressed the need for developing a team effort recognition plan that outlines the criteria used to evaluate the team accomplishment.

Communicating project progress: There is a need to constantly update the team about how the company is doing. People like to know what is happening in other parts of the company and how they themselves fit in and are contributing to the bigger picture.

Creating and sharing a team profile: Creating and sharing a team profile was seen by most interviewees as a way to get to know each other. Management asked every member in the

team to complete a profile and post it on a shared folder. It is important to include basic information such as a member's most productive time of the day, communication preferences and hobbies. Further analysis of the interviews revealed that most organisations hold a teleconference meeting to focus on the profiles of individual team members. This meeting was dubbed a *get-to-know-each-other* meeting. Team members will be asked to share information about themselves. One team member said: *"Team profile helps us to identify the traits and hobbies that we have in common with our colleagues."*

In case 3, interviewees expressed the need to have team building exercises. They explained that team building helps team members to get to know each other better, strengthen working relationships and ensures that the team works as a unit. Team cohesion was lacking in case 3. The majority of respondents in case 3 felt that there was a lack of team spirit between the Dubai team and the USA team. For example, consider the following statement: *"We [Dubai team] felt that we are a separate team from them [USA team]. However, the management of both teams do interact."*

Developing Trust

Several researchers identified trust as one of the success factors in a globally distributed software development environment. Many researchers pointed out that trust is the basis of successful cooperation among team members in the organisation. In this study, the issues of trust clearly emerged as important during data analysis of the three cases. Interviewees suggest that trust is vital for effective team performance. In case 1, this point was summed up in the following statement: *"Virtual teams are linked together by technology, but for them to work together, they need trust to develop among themselves."*

In case 2 one respondent explained the following: *"Yes, trust is crucial in virtual teams that are only linked by technology."*

We observed that a certain level of trust needs to be developed in different ways:

- Member to member
- Remote location to remote location
- Manager to employees

Our data analysis highlighted that there was some level of trust in all three cases. For example in case 1 the team in India explained through a telephone interview that: *"We trust*

that the guys in Abu Dhabi are capable of accomplishing the work assigned to them and they have proved that.”

He was also quick to mention that when they started off-shoring software testing and maintenance to Abu Dhabi and Oman, they had issues with trust. Since these teams were collaborating for the first time, it was difficult for them to trust each other. The India team had little trust in the Abu Dhabi and Oman teams for performing tests and maintenance work and they felt that they had to verify their work before delivery of the final product.

Our data analysis of the three cases indicated that a lack of trust had a negative effect on communication between remote teams. The following statement from case 3 supports this observation: *“We were sceptical about their [USA] sincerity when we started. We thought they wanted to use us to gain access to the Middle East market, so we were reluctant to share our information.”* This statement was made by one respondent based in Dubai (case 3) when they started the project. The same sentiments were expressed by the team based in Oman (case 2) and they explained that a lack of trust can cause barriers in communication between sites. They also explained that without trust there would be less collaboration, creative thinking and productivity. This will in turn result in virtual teams not being able to coordinate their activities since there is mistrust. He also explained that instead of team members focusing their effort to accomplish team goals, they spend most of their time protecting themselves and their interests.

Our research also found that a lack of trust negatively affected team cohesion. This was demonstrated when the organisation in case 1 brought developers from India to train the Abu Dhabi and Oman based remote teams during the initial stages of the project. While top management viewed this as a knowledge-transfer and a team building opportunity, the teams based in Oman and Abu Dhabi thought that their skills were being audited. A team member based in Oman stated: *“At first we thought they came to evaluate our skills, so our members were unwilling to cooperate.”*

Interviewees from all three cases mentioned that a lack of trust between remote sites negatively affected coordination. One team member in case 2 stated: *“Managing people who do not trust one another is a challenging and draining task. They battle over responsibility and they do not cooperate with each other.”*

Many of the team members interviewed concurred with the above statement. They also added that it does not matter how capable the team members are, the advantages of global distributing software development may not be realised if trust is not present. If remote sites are reluctant to cooperate with each other, task coordination is difficult. This will result in a project taking longer than necessary to complete.

However, as the all teams in all the three cases continued to work together, the management realised the need to implement practices that address trust challenges.

Many interviewees admitted that it is not easy to achieve trust, especially in a virtual environment. They also mentioned that trust is developed over time and since the team had worked together on some previous projects, they had learned to develop this trust.

Managers should not expect trust to develop among team members without effort. They need to be pro-active, implementing practices that promote trust within the virtual environment.

The analysis of the data gathered, indicated that having a face-to-face meeting before the start of a project is crucial to create trust in a team. An initial face-to-face meeting gives team members a chance to get to know each other and it also gives them the opportunity to display their competence to the other team members. When members know each others' competencies, it is easier for them to trust each other. This was illustrated by one respondent in case 1 when he said: *"It is really important for the guys to meet face to face for them to know each other. An initial meeting is also crucial for brainstorming and it is through this meeting that members know each other's capabilities. Once the members know each other's capabilities, it's easy to exchange technical information. When teams are talking to each other, trust develops. When the Indians guys came down here, it really changed the way we talk to each other. We start to get along with each other."*

In case 3 where it was not economically viable to have a face-to-face meeting, many of the team members interviewed identified making information regarding the technical ability of team members available in all the locations as a way to increase the level of trust. The organisation developed a skills database that was used to identify subject matter experts in all the locations. This allowed the team members to determine the skills levels of their remote colleagues. One team member (case 3) stated: *"When the guys know each others' capabilities and technical skills it is easier to trust each other. We need to know the technical skills of our remote colleagues to have confidence that they will be able to accomplish the tasks given. If*

any of the guys has a technical problem, it's simply a matter of searching the skills database to find an expert in that area. And when the guys are talking to each other, trust develops."

It emerged from the data analysis that honesty is the foundation of trust. Many team leaders interviewed agreed that project managers need to share information about project goals, resources and status and also provide explanations for decisions made. We observed that most project managers in the cases 1 and 2 held video conferences with all the teams located in different locations to discuss project progress. These meetings provide the opportunity for team members to communicate with each other. One team member in case 2 stated: *"You need to get everyone talking to each other and when your guys talk to each other, trust develops."*

Facilitate socialisation

In the Middle East personal relationships do take higher priority than competence hence it is important to ensure that team members are encouraged to develop a personal relationship with each other. Socialisation between team members in remote locations was identified as vital in cases 1 and 2. Project managers are encouraged to provide an infrastructure that facilitates social activities such as discussing personal issues virtually.

This was explained by one respondent in case 1 when he said: *"In our business we have a chat room open for each team in the business. Team members leave messages for the team that they are a part of. It's essential to keep these chats alive but not distracting. There's enough conversation to be able to discuss important issues and to feel like we're connected as one team, but not so much that it becomes distracting."*

We also have a fun company-wide chat room open for non-business related chats. This creates a bit of a water cooler effect where employees can chat about anything they like."

In case 1, when the organisation started offshoring some of its software development work to the Middle East, the team members did not know each other. It was only the team based in India that had previous experience with global development projects. During the initial stages of the project, the major challenge was to get the team members talking to each other. The management decided to set up an introductory meeting using video conferencing involving team members in all locations. One member stated the following: *"When a new member joins any of the teams, we make a point that we introduce that person to the rest of the team"*

members during our next video conference. The main reason is for the rest of the guys to get to know the new member so that it is easy to talk to him. The new member will talk about his or her background, his previous experience, his hobbies and likes.”

It was observed that the managers encouraged personal connections during videoconference meetings by encouraging people to talk about what is happening in their lives, both professionally and personally.

It also emerged from interviewees in case 1 that there was a weekly tele-conference meeting among managers and key team members at all remote sites. Although the main purpose of these meetings is to share project information, the interviewees felt that it also promoted socialisation between team members. One team member admitted that those meetings helped him to build better relationships with the team based in India.

In case 2, we discovered that informal conversations which are normally missing in virtual teams, is crucial to build team rapport and cohesiveness and eventually develop trust and effective communication within such a team. It is important for the virtual project manager to encourage informal communication. To encourage socialisation between remote teams, regular status meetings normally started or ended with non-work-related discussions. We discovered that the project managers were making a conscious effort to openly discuss informal and unstructured topics. That encouraged other team members to follow suit. Team members were encouraged to present informal topics about their social lives or interests so that the other members could learn more about their backgrounds.

In case 3, we did not find any measure or policy that encouraged socialisation between team members at different sites. The majority of the interviewees pointed out that there was a lack of team spirit between the teams in USA and Dubai, which was evident in the way norms and attitudes were not shared. For example, one respondent based in Dubai stated the following: *“I do not know most of the guys in the USA.”* Instead, cross-site communication was done through one person.

We discovered that in the Middle East, women are quite and more reserved especially when around Muslim men. In addition, women are not allowed to shake hands with a male. This should not be interpreted as unfriendly and anti-social. While women are respected, their place in society is generally viewed as one subservient to men. Consequently, mixed-gender social interactions are unusual and fraught with social and cultural landmines.

4.2.1.2 Effective communication

Communication plan

Developing a communication plan was identified in all three cases as important for effective communication in distributed teams. Respondents in cases 2 and 3 explained that a communication plan is crucial for developing appropriate communication strategies that ensure information is provided in the right format, at the right time and to the right audience. In case 1, we discovered that for a communication plan to be effective, it should be based on the communication requirements of all the team members. This was illustrated by one respondent when he said: *“Thinking and planning about how we communicate is vital for our team. All stakeholders have to contribute since this will help the organisation to come up with communication strategies that satisfy everyone.”*

Elaborating on a communication plan, the project manager will have an opportunity to think about the appropriate technology team members will use to communicate and how project information will be communicated to the management and various stakeholders.

Our data analysis of all the three cases identified the following needs to be included in the communication plan:

- Which official language is to be used?
- What communication technologies are to be used?
- How team progress is communicated to team members?
- When to have face-to-face meetings?
- What training is needed for team members to effectively use the communication technology?
- When to use synchronous communication technology and when to use asynchronous communication technology?

The interviewees in all three cases also pointed out that if a communication plan is implemented, it helps to avoid communication breakdown. We discovered that communication between team members is challenging in the Middle East due to salary and position inequalities that are based on gender, race and nationality. Male nationals always rate higher on the positional scales than their female counterparts. The Western expatriates are paid higher salaries than other nationalities. Promotions are based on nationality and not on qualifications. Western expatriates and local Arabs are more likely to be given positions

with higher responsibilities than Asians. This was explained by one member in case 1: *“Here salary does not depend on your experience or qualification but on where you come from. Western expatriates and locals are paid more than Asians.”*

We also observed that in the Middle East, women who are in management positions normally do not receive the same recognition as a man in a similar position. A female project manager in case 2 responded by saying: *“I felt that my subordinates are undermining my position, maybe because I am a female.”*

A communication plan helps to identify all those potential communication challenges that are likely to cause communication breakdowns. A communication plan documents the communication approaches used to satisfy all the communication requirements of stakeholders.

The research also revealed that it is important to constantly conduct an audit on the existing communication processes and methods. Conducting an audit helps management to evaluate whether existing communication tools and methods assist the team in meeting the project objectives. The communication audit should focus on the following:

- Virtual team members who send and receive messages
- The mode of communication
- The effectiveness of tools used for communication (internet, telephone, email, video conference etc.)
- The attitude of team members towards an existing communication plan.

The communication audit acts as a critical tool used to identify any problem areas and develop best practices.

Communication Rules

In case 3, establishing communication rules was identified as essential for effective cross-site communication. This involved establishing communication guidelines and having mechanisms in place to identify the optimum practices for communication between virtual teams. Evidence gathered shows that cross-site communication was done through one person (a liaison officer) at each site. This was explained by one respondent in Dubai who said:

“We have a standard that says all official communications should go through the liaison officer. He is the one that knows English very well.”

Communication between the organisation and the customer was restricted to management only. This ensures that there is consistency in the information released to customers and it also frees developers from this responsibility so that they can concentrate on their core task of developing software.

The rules were also set on how frequently cross-site meetings are to be scheduled to monitor progress and discuss open issues. The rules also determine which meetings were mandatory. These meetings were held mainly through conference calls and video conferencing. This was explained by one respondent based in Dubai when he said: *“Everyone is aware when we hold our meetings. We have a meeting schedule.”*

Language

In all three cases, interviewees agreed that one of the prerequisites for global software development to succeed is the use of a common language. All participating members in different locations should be proficient in that language. The official language used for day-to-day operations of the virtual team in all three cases was English. Team members in all the locations were required to be able to speak and write in English. Proficiency in English was viewed by many interviewees as a way to ensure effective communication.

The official language in Oman, Dubai and Abu Dhabi is Arabic. English is used mainly in the business community and is also taught in schools as a second language. The official language in India is different from state to state. The most widely-spoken language is Hindi with about 422 million speakers. English is used in the business community and is also taught in schools as a second language. The native language in the USA is, of course, English.

In all the remote locations except the USA, English is not the native language. Teams based in India were viewed as being able to write and speak English well. This was confirmed by one interviewee in case 2 through a telephone interview when he said: *“All guys here are able to write and speak English fluently.”*

The analysis of the data from all three cases indicated that the Middle East based teams have a mixed level of competency in English. Commenting on the level of competency of the teams based in Oman and Abu Dhabi, the interviewee in case 1 described them as “mixed”.

He stated that: *“You find guys who are really good in English and some guys really struggle to speak fluently.”*

The majority of the interviewees in all the cases echoed the need for training for effective communication in English. They also encouraged the use of simple and precise words when speaking to colleagues in remote locations. Use of local expressions was discouraged. In cases 1 and 2 management offered all the team members an intensive English course. One team member in case 2 acknowledged that the English course helped him to write and speak English fluently. In case 3, the respondents in Dubai were asked if they had received training in English. The majority responded: *“No, but would love to receive such training.”*

Furthermore, it emerged that many team members interviewed in all three cases felt the need to have a common vocabulary. They felt that embracing a common vocabulary was necessary to ensure a shared understanding of the major organisational terms for project artefacts, acronyms and procedures. One project manager in case 2 stated the following: *“We make sure that during process training, we explain all the key terms and commonly used acronyms used in documentation. This really helps for our team members to have a shared meaning of all those terms.”*

4.2.1.3 Tools and Technology

ICT infrastructure

Having the necessary ICT infrastructure and tools to support remote site efforts was important in all the studied cases. ICT infrastructure enables connection between remote teams. This includes physical connectivity, server configuration, application, extranets, conferencing tools, as well as network speed and bandwidth. This was explained by one respondent who said: *“The technology is there to support virtual teams. There is really no reason to be without it. Having the right ICT infrastructure is very critical because all our work is based on collaborating with the team in India. If that collaborating link is down then we have no work.”*

In order to succeed, the globally distributed development environment needs a good ICT infrastructure to support the following:

- **Fast internet:** Fast internet enables quick access to the network by all members in remote locations.

- **Extranet:** This helps to host a secure project management portal.
- **Screen-sharing tool:** This tool allows a developer to share a screen with a fellow developer in a remote location. Some of these tools even allow a remote team member to control another computer remotely.
- **Shared Database:** Having one central database accessible over a WAN from remote locations ensures that everyone is working with the latest versions of files and components.
- **Web access:** Web access is needed for web-based applications such as version-control systems which allow team members to share software artefacts in a monitored way.

Table 6 shows requirements for an ICT infrastructure identified in the studied cases and compares the results of the three cases (‘+’ indicates important, and ‘-’ indicates that the requirement is lacking). It is clear from table 6 that all the requirements for a good infrastructure were considered important in all the cases.

Table 6: Requirements of ICT infrastructure

Requirement of ICT infrastructure	Case 1	Case 2	Case 3
Fast internet	+	+	+
Extranet	+	+	+
Screen-sharing tool	+	+	+
Shared database	+	+	+
Web access	+	+	+

Setting up an appropriate infrastructure was seen as a way to facilitate the integration since it allows distributed development work to be brought together. Hence this reduces the impact of coordination breakdown. This was explained by one of the respondents in case 2 when he said: *“Our network infrastructure allows our developers to share and integrate their development work seamlessly.”*

Cloud-based development tools

Cloud-based software development tools include tools for the development and management of components, configuration and version management tools, as well as tools for testing and tracking bugs. Interviewees perceived that using cloud-based development tools such as IDEs and code editors in a globally distributed development environment offers a standardised development platform. This eliminates the need for developers at different sites to have local IDEs and other development tools. This also helps developers to enforce standard programming models and to ensure that everyone adheres to coding standards, thereby producing a quality end product. This was explained by one respondent in case 2 when he said: *“In our case software development tasks are distributed across sites. To avoid integration problems, we are using cloud-based development tools to make sure that everyone is using the same development platform. With cloud-based development tools we can enforce constraints which ensure that all developers adhere to the same coding standards and conventions.”*

Interviewees also perceived that using cloud-based development tools make coordination of activities easier. This is because project-related information such as requirement documentation and project status reports can be generated by content collaboration spaces incorporated in cloud-based development tools. Using these tools enables project managers to check the progress of the project. This was explained by one respondent when he said: *“Coordination of tasks in various sites is no longer an issue. We have enabled content collaboration spaces in a cloud-based development platform mainly for the exchange of project-related information between sites. Information such as percentage completion of the project can be generated automatically to indicate the performance of each team.”*

Collaborative tools

Data analysis indicated that the organisations provide a wide variety of tools for distributed team members to communicate with their remote colleagues. The communication tools that were provided include telephone, email, chat programs and video chat. Interviewees indicated that while it is important to provide effective collaborative tools, it is also equally important to ensure that people are equipped with the required skills and are also motivated to fully make use of them. This was explained by one of the respondents in case 2 when he said: *“Installing the collaboration tools is important for our organisation. But equally*

important is to make people use those tools effectively. People need to be motivated to use the tools and they also need appropriate training how to select the appropriate tool for a given situation.”

Interviewees in all three cases felt that collaboration tools promoted effective communication between team members. The tools provide a platform for members to discuss progress of the project thus facilitating the development of good working relationships. When good working relationships are developed between members in distributed teams, people in various sites feel that they are part of a team, thereby increasing the team spirit. *“All that is required is to create a platform where team members can communicate freely. When team members are communicating they get to know each other and when they know each other it’s easy to work as a team.”*

Data analysis from the three cases indicated that collaborative tools also provide the means through which team members can communicate the progress of a project to the project manager. Thus the project manager will be able to control the progress of the project. *“When team members are able to talk to each other, it’s easy to control the progress of the project.”* Management should make sure that appropriate tools, both synchronous and asynchronous, are made available to the team members.

The following section discusses the various collaborative tools used in the three case studies.

- **Email:** In all three studied cases this is used for the communication of issues that do not need an immediate response. It is also used to share calendars. This keeps the remote team informed of the public holidays of the other remote locations. Office 365TM was used to support such communication in most of the studied cases. Email was the most frequently used method of communication in all the studied cases. The following statement summarises why it was preferred: *“Email is handy because some guys in Oman and Abu Dhabi are not good in English. With email, it is easy to use translation software to translate from English to Arabic.”*

Most interviewees felt that email is necessary and the most appropriate communication method because of the difference in working days between India, Oman, Abu Dhabi and the USA - hence the need for an asynchronous communication tool. India’s working days are Mondays to Saturdays whereas in the USA working days range from Mondays to Fridays. On the other hand, the Middle East has Sundays to Thursdays as working days. As a result, there

are only four common working days between all the sites. Communication across sites on Fridays, Saturdays and Sundays needs to be done via email.

Data analysis of the three case studies also revealed that email was the preferred method of communication to distribute team-wide non-urgent issues. In the three case studies, the organisations are using project-wide mailing lists to communicate important issues such as the agenda of meetings, minutes of meetings, important announcements and decisions made to everyone involved in the project. Using email to send information such as the agenda of the next meeting is vital because it allows team members to have time to read the agenda and prepare for the meeting. The majority of the interviewees regarded email as a formal means of communication. One respondent outlined the benefits of using email when he said: *“The beauty of using a mailing list is that everyone will have a copy of the email. Each member will be able to retrieve the email from their mailbox when they require them.”*

Many people interviewed were of the opinion that team members prefer to use email to communicate issues of low complexity such as status reports.

One challenge which was cited by the majority of the respondents was the delay in getting responses. One respondent based in India stated the following: *“If you write an email on Friday, you only receive the response on Monday. The delay affects our operation.”* Another respondent based in the USA in case 3 concurred with the above statement. He stated the following: *“It takes a lot of time to get a response from email.”*

Chat programs: In all three study cases, most interviewees stated that in software projects, technical personnel need to share technical artifacts which include software source codes, configuration files and test cases. Technical artefacts are difficult to express verbally, mainly because they are composed of characters that are not part of a natural spoken language. Text-based communication is the natural choice for sharing those technical artefacts. One developer in case 3 stated the following: *“It is very handy to send an email or a chat message for things like variable names, some codes and technical class names.”*

Many interviewees indicated that they used a chat program to communicate with other team members. One developer stated the following: *“Google chat is a great tool for quick instant messaging and for creating a team chat environment.”*

A chat program was used in all the studied cases. One respondent stated the following: *“Our guys used a chat program a lot. It is a very useful tool for us to communicate.”* One advantage that was cited by the majority of the team members who use a chat program, was that it shows the people who are currently online. A chat program also allows members to write status messages that show whether they are busy or available or not available.

Many interviewees indicated that the chat program is regarded as an informal way of communicating, hence making it possible to neglect communication etiquette such correct spelling or grammar. Most of the communication tends to be in shorthand. The chat program is also used to complement video conferencing as it can be used to ask quick questions without disturbing the flow of the meeting. *“You can post quick questions to the panel without disrupting the flow of the meeting.”* Many of the interviewees stated that a chat program delivers messages instantly and activates a pop message, thereby alerting the recipient of this new message. Many interviewees were happy with a chat program’s ability to deliver a message promptly, making it a useful tool to communicate quick questions.

“The chat program that we use is called ‘hangouts’; it allows us to do group chats. The chat occurs in real time so it’s good for quick communication.”

We also discovered that Skype™ was not allowed in some Middle Eastern countries. This limits the distributed team on the choice of tools.

Phone calls or video chat: In all the three cases, issues that require immediate response and that might require further explanation are communicated using phone calls or video chat. Video chat was preferred because it gives more visual cues. Video chat allows all participants to see the facial expression of others. The one conversing will be able to evaluate whether the communication was successful or whether further elaboration is required with the help of visual cues. The one talking is seen by everyone in the meeting which makes it easy to follow basic meeting practices. One developer in case 2 stated the following: *“Video chat is good because all participants see each other. This make it feels like your team members are with you in the room.”* Interviewees explained that video chats make participants more attentive in a meeting. This is because the participants can see each other during the meeting.

Creating a short video: In case 1, all training sessions were recorded using a webcam and posted on an extranet. Sharing videos were seen by many interviewees in case 1 as expanding collective knowledge of the dispersed team. This practice includes sharing videos of the

national cultures of remote colleagues and videos on how to use new technology. Recorded videos were uploaded on the company extranets when introducing a new technology.

Table 7 shows the collaborative technologies that were identified as important for collaboration between remote teams and compares the results of the three cases ('+' indicates important and '-' – not mentioned).

Table 7: Collaborative technology: Results of the three cases

Collaborative technologies	Case 1	Case 2	Case 3
Email	+	+	+
Chat program	+	+	+
Phone	+	+	+
Video chat	+	+	+
Creating short video	+	-	-

4.2.1.4 Project management: managerial practices

Planning

Project planning was identified as an important prerequisite for the success of distributed software development operations. This includes macro and micro planning. Macro planning includes the way in which tasks are going to be distributed amongst remote teams, as well as setting up major milestones which the teams should use to guide their activities. This was explained by one respondent in case 1 when he said: *"The product manager in India gives us an overall plan and also provides the milestones. Then we sit down as a team in Abu Dhabi and set up our own plan. Our plan should fit in within the overall plan."*

Micro planning is done by each individual team. This includes assigning tasks to team members and also estimating how long each task should take. One respondent in case 2 explained this when he said: *"We do the day-to-day planning. Our team leader assigns a task to each team member and we sit down to set the timeline for each task. The plan we set is obviously derived from the overall plan from our boss in India."*

Interviewees also indicated that it is important to include project members from all sites in a planning session before the onset of the project. This is because people are more likely to be committed to a project when they are actively involved. In these planning meetings, tasks can be identified and assigned to team members. It is vital to make sure that everyone is aware of task priorities. To ensure that developers are committed right from the onset, they are encouraged to contribute to the work estimates. This was confirmed by the following comments (case 2): *“We do planning together with the guys in India. Everyone is involved and when everyone is involved, everyone understands the scope of the project. The fact that the guys understand the project and they will have contributed to the planning process, increases the chance of completing the project on time. Everyone will be motivated to complete the work assigned.”*

Develop project objectives and success measures

Developing clear project objectives is vital to globally distributed teams. This was explained by one respondent when he said: *“To make everyone understand what needs to be done, we set objectives and it is against those objectives that we measure the performance of the team members.”*

By setting clear objectives, project milestones are also set in advance. The project manager should make sure that common objectives are agreed on and understood by all the team members. When team members are clear on what they are supposed to achieve it helps them to stay focused. One respondent explained that the success measures should be measurable, attainable and specific.

When project objectives and success measures are set, it is easy to coordinate activities at different sites. This is because work in different sites can now be measured against success measures.

Empirical evidence gathered in all three cases indicates that defining a baseline for key performance metrics, following a clear but flexible set of procedures, is very important for managing quality in a distributed software development environment. Analysis and corrective actions should be planned in case actual results deviate from the baseline or expectations.

Use of collaborative project management tools offers a project manager in India a web-based interface to manage project information such as calendars and milestone tracking. This gives the project manager a crucial overview of the project status at different virtual locations. This also helps the project manager to control the project and ensures that it is delivered within an agreed timeframe.

Communicate the project plan

We observed that communicating the project plan is crucial so that everyone is aware of the intricate pieces of the project schedule. The project plan should be accessible to every member in the project once it has been created and developed. As explained earlier, collaborative development of the project schedule ensures that everyone in the project understands the project milestones and that they are well articulated by everyone. Interviewees felt that it is important that major milestone dates are emailed to everyone in the global team. The entire project plan and the whole schedule is publicised online in a workgroup tool. Interviewees indicated that they received updated lists of the major schedule milestones every week. *“An updated list of major schedule milestones which is sent weekly is beneficial to everyone to see the milestones and dates that have been reached and track progress of each team.”*

When a team meets its milestones, management sends a congratulatory email to that team and also copy the email to all the teams in the project. This helps the other teams to be aware of what is happening in other teams.

4.2.2 Success in global software development

This section presents evidence collected through interviews regarding the success achieved in this case study. The evidence (quotations from interviews) is presented according to the categories of success identified in literature are as follows:

- Improved communication
- Improved collaboration
- Improved social ties
- Product success

Improved collaboration

Sarker and Sahay (2004) suggested that temporal distance reduces the chances for real time collaboration. This was not the case in this case study. One respondent in case 1 had this to say: *“Cloud-based software development tools make collaboration easy and we can coordinate our working. It offers a standardised development platform and ensures that all our developers adhere to coding standards regardless of their location. It is a very handy tool for our developers to collaborate.”*

In case 2, one respondent stated the following: *“Oman, Abu Dhabi and India are almost in the same time zone. Oman and Abu Dhabi have the same time whilst India has a time difference of less than one hour. This means we have 7 hours overlapping time in which we can work together.”*

In case 3, temporal distance was viewed as an advantage. One respondent in case 3 explained as follows: *“Time difference is not a problem to us, actually it allows us to work around the clock. We can actually provide support to our customer almost 24/7 from Monday to Thursday. We can forward the customer calls from site to site to provide a 24 hour service to our customer.”*

Improved Communication

In case 1, participants perceived that there was improved communication between remote team members. One respondent in case 1 stated the following: *“We use MSN messenger from Microsoft - every member of the software development group, they appear on the list. So to have a chat with someone, wherever they may be in the world at the given time, you just need to double click on their name and start typing a line.”*

Many interviewees in cases 2 and 3 perceived that effective communication was achieved through the implementation of a variety of ICT communication tools despite geographical distance: *“We have a wide variety of communication media. For those who can communicate better by using email, we have email facility and for those that are good at speaking, they can use either the telephone or chat program or video conference. This has worked effectively.”*

Improved social ties

It also emerged that there was a good working relationship between remote teams despite the distance that separates them in cases 1 and 2. Although previous research on global software development indicated that team members in remote locations are less likely to view each other as belonging to the same team, this was not the case in this study. One member who was based in India (case 1) stated the following: *“Our work here depends on the Oman and Dubai teams because they are close to the market. They know what the customer needs.”* The same feeling was echoed by the team based in Abu Dhabi (case 1). One team member stated the following: *“They [India] have all the senior software engineers there, but here [Abu Dhabi] we know what the customer wants. So we have learnt to work together in order to deliver a quality product to the customer.”*

In case 2, one respondent explained the following: *“Our working relationship is good. We work very well and I know the majority of the guys in Oman and Abu Dhabi.”*

In case 3, interviewees reported a number of problems related to social aspects. There was a lack of team spirit between the Dubai and USA teams because the team members in Dubai did not know their remote workmates. Cross-site communication is limited to management only. Although interviewees expressed the need for team building exercises to bring the two teams together, nothing was done by management. Also, management wanted to reduce project costs by reducing travelling, ruling out the chance of the two teams having face-to-face meetings.

Product success

In case 1, interviewees have reported a 5% increase in sales since the product was launched in the market. A project manager said the following: *“Our product has performed well. Our sales department has reported a 5 % increase in sales.”*

In case 2, interviewees reported that they were able to release the software product within the budgeted time frame. One respondent explained the following: *“Despite the fact that it was not easy to set up a global project, we managed to successfully launch our product to the market within the budgeted time frame.”*

In case 3, the product was highly successful. The customers interviewed expressed satisfaction regarding the use of the software product. One customer interviewed said the following: *“I like the software. It’s a value for money. They are very efficient when it comes to providing technical support.”*

4.2.3 Managerial practices that contribute to success: causal relationships

The frequency of instances in which managerial practices were linked by interviewees to general challenges is presented in table 8. The table shows the causal relationship between the success factors and the success categories measuring general GSD challenges as perceived by the interviewees. The causal relationship between a factor and a category of success exists if at least one relationship between any of the managerial practices and a specific category of success was identified. The number represents the number of links that could be established. The higher the number, the stronger the relationship.

Table 8: Contribution of factors to success of the cases

	Success			
Managerial practices	Improved communication	Improved social ties	Product success	Improved collaboration
A) Cross- cultural collaboration.	+	+	+	+
1. Cultural awareness	3	9	2	5
2. Team building	5	5	6	4
3. Trust	4	7		3
4. Facilitate socialisation	5	7		3
B) Effective communication	+	+	+	+
5. Language	4	3		3
6. Communication plan	5		4	6
7. Communication rules	3	4	5	
C) Tools and Technology	+	+	+	+
8. ICT infrastructure	5	4	4	5
9. Cloud-based development tools	6	3	5	2
10. Collaborative tools	7	4	3	5
D) Flexible project management	+	+	+	+
11. Planning			3	3
12. Develop project objective and success measures			4	5
13. Communicate the project plan	3	7	2	7

4.3 Conclusion

In this chapter the analysis and results of the three case studies were presented and discussed. The success factors and quotations from interviews supporting these factors and their contribution to success were presented.

The results of the studied cases show that the interviewees identified factors as suggested in the literature as contributing to the success of globally distributed software development projects.

In relation to *cross-cultural collaboration*, cultural awareness was identified as a way to bridge cultural differences. Cultural training was given a high priority as a way to establish cultural awareness of distributed teams. Team members were attached to a remote location as a way of learning about the culture of remote colleagues.

Team building exercises that involve cross-site activities were viewed as important in globally distributed software development environments because it helps each member of a team to have shared goals and to get to know each other better. Interviewees indicated that it is through team building exercises that remote teams realise the importance of working as a team and also in developing relationships. Various teams-building exercises were identified as crucial, such as creating a team charter, acknowledgement of a team effort and creating and sharing a team profile.

Developing trust was identified as an important success factor in global software development. Many of the team members interviewed identified the availing of information regarding the technical ability of team members in all the locations as a way to increase the level of trust. It was observed that many organisations keep a skills database of remote team members so that the team members are aware of each others' abilities. This will build confidence that remote teams are capable to deliver quality software products on time. Project management needs to give honest information to all the team members about the progress of a project.

Interviewees felt that if the project manager facilitates socialisation of cross-site team members, it helps team members to build relationships. When relationships develop it helps team members to communicate with each other. The management sets up an introductory meeting at the onset of a project. This is followed by regular weekly teleconferencing meetings to discuss the project progress with all the team members.

Under *effective communication*, interviewees agreed that one of the prerequisites for global software development to succeed, is the use of a common language. All participating members in different locations should be proficient in that language. Team members need extensive training in the official language used for communication across sites. Furthermore, it emerged that many team members interviewed felt the need to have a common vocabulary. They felt that embracing a common vocabulary was necessary to ensure a shared understanding of major organisational terms for project artefacts, acronyms and procedures.

Developing a communication plan was also viewed as important for effective communication in distributed teams. Interviewees argued that a communication plan is crucial for developing appropriate communication strategies that ensure that information is provided in the right format, at the right time, to the right audience using the right technology.

Concerning *tools and technologies*, interviewees considered having the appropriate ICT infrastructure and tools such as physical connectivity, server configuration, applications, extranets, conferencing tools and network speed and bandwidth as important in global software development. Development teams at different sites need to use cloud-based development tools to ensure standardised development platforms. A wide variety of collaborative technologies were made available to disperse team members. These include email, chat programs, phone calls and video conferencing tools.

Regarding *project management*, developing clear project objectives was considered by many interviewees as vital for globally distributed teams. It is also important to include project members from all sites in the planning session before the onset of the project. Team members are more likely to be committed to the project when they are clear about what needs to be achieved.

In this chapter, we discussed the findings of the three case studies. In the next chapter, we present the analysis of the findings.

CHAPTER 5: ANALYSIS AND DISCUSSION

In this chapter, the analysis of the findings is presented and discussed. The factors and managerial practices that were perceived as important in the three cases are analysed and propositions that suggest the link between factors and managerial practices and measures of success are formulated. Firstly, managerial practices and factors perceived as important for success in globally distributed software development in the three studied cases are compared, and propositions that suggest relationships between specific managerial practices and dimensions of success are formulated in section 5.1. In section 5.2, factors perceived by interviewees as contributing to success in the studied companies are compared and the conclusion of the chapter is presented in section 5.3.

5.1 Managerial practices and factors perceived as important for success

In total thirteen managerial practices and factors were identified as important in the studied cases. Most of the factors were identified in all three cases, but some were identified in two out of three cases. A communication rule was unique to case 3 only. Table 9 lists the factors identified in the three cases. The factors are discussed and compared and contrasted with the existing literature.

Table 9: Success factors and managerial practices

Success factors and managerial practices
A) Cross-cultural collaboration
- Cultural awareness
- Team building
- Trust
- Facilitation of socialization
B) Effective communication
- Communication plan
- Communication rules
- Language
C) Tools and technology
- ICT infrastructure
- Cloud-based development tools
- Collaborative tools
D) Project management
- Planning
- Developing project objectives and success measures
- Involving the whole team in planning

A. Cross-cultural collaboration

Cultural awareness

Increasing awareness of cultural differences among team members was identified as important in cases 1 and 2 which were in line with findings from research done by Milewski et al (2007) and Cataldo and Herbsleb (2008). The evidence gathered from all three cases suggests that increasing global cultural awareness and developing a global mind-set, help to provide a conducive work atmosphere in which virtual teams view themselves as a part of the global team. We found that increasing cultural awareness in virtual teams helps teams to develop what Shapiro, Ozanne and Saatcioglu (2008) calls a “compromised culture” whereby team members can tolerate one another’s cultural differences. This helps to reduce cultural clashes and communication breakdown. The predominant religion in the Middle East is Islam. Project managers are encouraged to respect prayer times of individual team members to avoid cultural clashes. If possible, prayer rooms should be provided, and scheduling meetings during prayer times should be avoided to ensure that everyone participates. In case 3, where we did not find evidence that supports cultural awareness, interviewees reported a number of culturally-related problems. For example, respondents in USA complained that there was no interchange of information pertaining to public holidays between sites. This negatively affected cross-site communication. Participants reported the need to have cultural training. Cultural training should be incorporated during the induction of new team members. Based on the research findings, the following propositions were formulated:

Proposition 1a

Increasing awareness of cultural differences between remote teams impacts positively on communication.

This proposition suggests that, despite the distance that separates the remote teams, awareness of cultural differences is likely to avoid communication breakdown. Project managers are encouraged to consider prayer times when scheduling meetings.

Proposition 1b

Increasing cultural awareness reduces the possibility of culturally-related conflict among team members.

This proposition suggests that increasing awareness of cultural differences is likely to reduce the possibility of culturally-related conflict. Project managers are encouraged to provide prayer rooms, for example.

Team building

We discovered that team building is important in a globally distributed software development environment since it helps all the members of a team to have shared goals, vision and values and to be aware of the existence of the other teams. Team building was cited in cases 1 and 2 as a way to reduce the challenges of cultural clashes, communication breakdown and to increase team cohesion. In cases 1 and 2, a number of ways in which effective teams can be developed, have been identified. These include the following: creating a team charter, the acknowledgement of team effort, communicating project progress, and creating and sharing a team profile. Team building was done to ensure that team members get to know each other better.

We also found out that team building activities help develop a “one team mind-set” between team members in different locations. This point was further illustrated in case 3, where team building was lacking. Interviewees indicated that the remote teams viewed themselves as separate teams. This negatively affected cross-site communication. Respondents in case 3 expressed the need for team building. This would help to bring together team members across different locations and encourage interaction between them. Creating and sharing a team profile help team members to identify common interests. When common interests are identified, it is easy for team members to develop a natural bond with their remote colleagues despite the distance that separates them. Based on the findings, we formulated the following proposition:

Proposition 2

Team-building exercises help team members to get to know each other better and have common goals despite differences in culture and the distance that separates them.

Developing Trust

The findings from the studied cases indicated that developing trust among team members is a key requirement for success. The analysis of the data gathered in cases 1 and 2 indicated that having a face-to-face meeting before the start of a project is crucial to create trust in a team.

An initial face-to-face meeting gives team members a chance to get to know each other and it also gives them the opportunity to display their competence to the other team members. In cases 1 and 2, the team members were located in countries that were relatively close to each other. This made it relatively inexpensive for the team members to visit each other. However, even though the team members were located in countries that were close to each other, face-to-face meetings come with additional cost. This therefore limits the number of face-to-face meetings. However, the effect of such meetings had a positive influence on team performance.

In case 3, where it was not economical for teams to visit each other, availing information regarding the technical abilities of the team members in all the locations was identified as a way to develop trust. This allowed team members to be aware of the competencies of their remote colleagues and to trust their future work.

We discovered that a lack of trust has a negative impact on collaboration, creative thinking and productivity. This in turn results in virtual teams not being able to coordinate their activities.

Based on the findings we formulated the following proposition:

Proposition 3

If people with different national cultural backgrounds collaborate over distance, developing trust will encourage team members to collaborate and to make them more likely to share information.

Facilitation of socialisation

We discovered that socialisation is a critical factor for distributed teams to develop norms, identity and cohesion. This improves the ability to work collaboratively and also improves communication. This was in line with the existing literature that argued that organisational socialisation has been positively associated with the strategic effectiveness of an organisation, inter-functional coordination capabilities (Ross Wooldridge & Minsky 2002) team performance (Hinds, Weisband 2003) and employee retention (Bigliardi, Petroni & Ivo Dormio 2005). In support of the findings of Kotlarsky et al (2005), we discovered that project managers need to provide an ICT infrastructure that facilitates social activities such as discussing personal issues virtually.

Data analysis of cases 1 and 2 suggests that various mechanisms were employed to ensure that socialisation would be made possible and also maintained throughout the project lifecycle. For example, holding video-conferences to introduce new team members to the global team was one element that interviewees indicated as important for collaboration. To encourage socialisation between remote teams, regular status meetings normally started or ended with non-work-related discussions. A progress meeting involved social activities that facilitated team members to discuss informal and unstructured topics. This helped the team members to get to know each other and created interpersonal ties regardless of the distance that separated them. On the other hand, teams in case 3 faced difficulties in developing socialisation. Cross-site communication was done through one person. This resulted in a lack of team atmosphere between teams in the USA and those in Dubai, which was evident in the way norms and attitudes were not shared. Based on the findings, we formulated the following propositions:

Proposition 4a

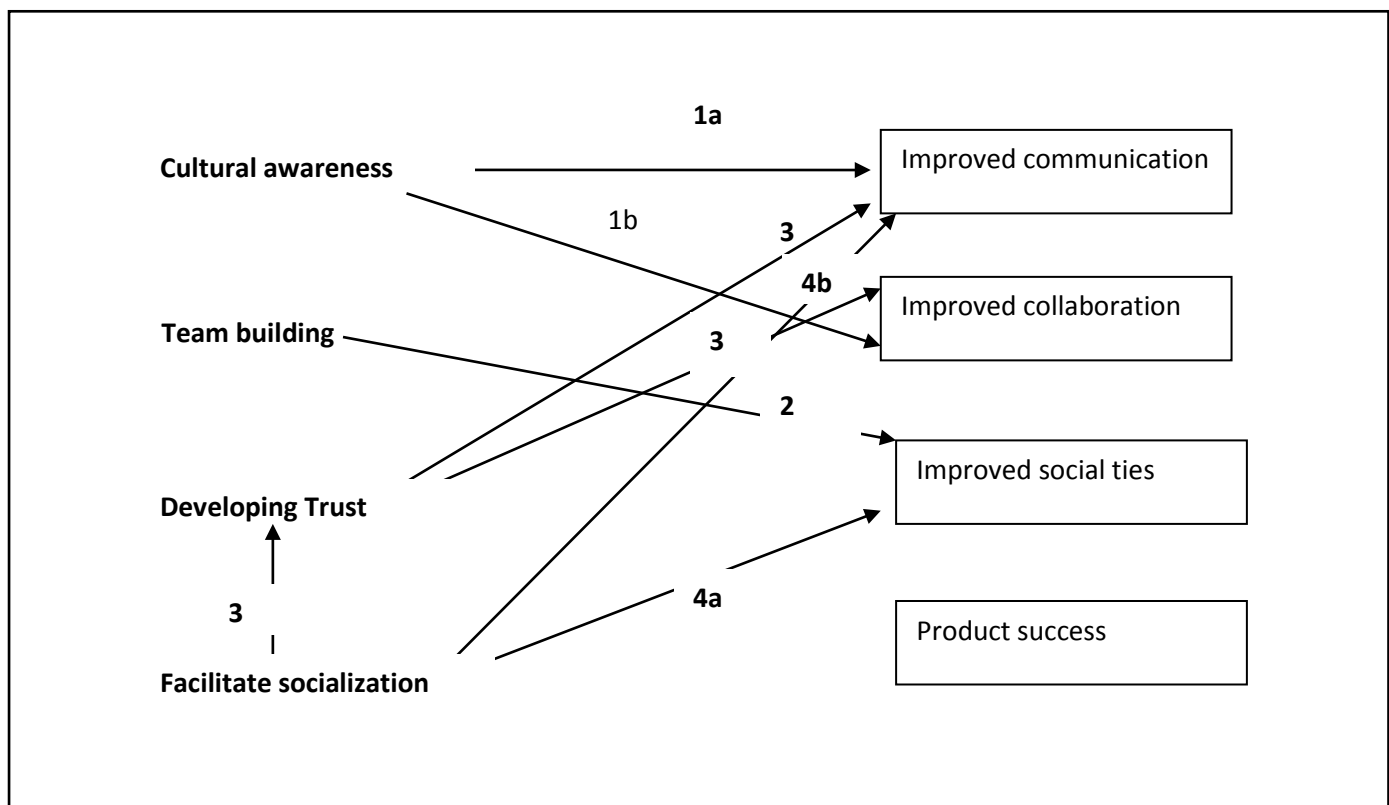
Facilitating socialisation and providing appropriate ICT infrastructure help the team members to get to know each other and create interpersonal ties and also help to develop trust regardless of the distance that separates them.

Proposition 4b

Facilitating socialisation positively influences cross-site coordination and communication capabilities, team performance and employee retention.

Figure 8 illustrates the relationships between propositions associated with cross-culture collaboration and the categories of success.

Figure 8: Cross-culture collaboration



B. Effective communication

A communication plan

Our research shows that communication planning is important to the ultimate success of global software development projects. McDonough, Kahn and Barczak (2001) pointed out that inadequate communication planning may lead to problems such as delays in message delivery, communication of information to the wrong audience, or insufficient communication with the stakeholders, as well as misunderstanding or misinterpretation of the message communicated. This was in line with what we discovered in this research: planning ways to communicate helps to identify potential communication bottlenecks that are likely to cause communication breakdowns. Angolia and Lesko(2014) stated that a communication plan should be constructed very early on, for example during project management plan development. The outcome of the communication plan could be used to allocate appropriate resources, such as time and budget, to acquire communication tools to be used by the distributed teams. We also discovered that for a communication plan to be effective, it should be based on the communication requirements of all the team members. Based on the findings, we formulated the following proposition:

Proposition 5

A communication plan based on the communication requirements of all the team members in a global software development project is likely to assist in reducing communication bottlenecks and improve effective communication.

A common language

Our data analysis revealed that the use of a common language is a prerequisite for global software development to succeed. Team members in all the locations are required to be proficient (speaking and writing) in that language for effective communication to take place. In all three cases, the language used was English. All three cases contained a mixed level of competency in English, hence there was a need for extensive English language training. When communicating with remote members, there was a need to keep the content simple and to the point to reduce misunderstanding. We also discovered that developing a common vocabulary was important to ensure a shared understanding of the major organisational terms for project artifacts, acronyms and procedures. Based on the findings, we formulated the following proposition:

Proposition 6

Use of a common language, providing extensive training and developing a common vocabulary, is likely to improve communication.

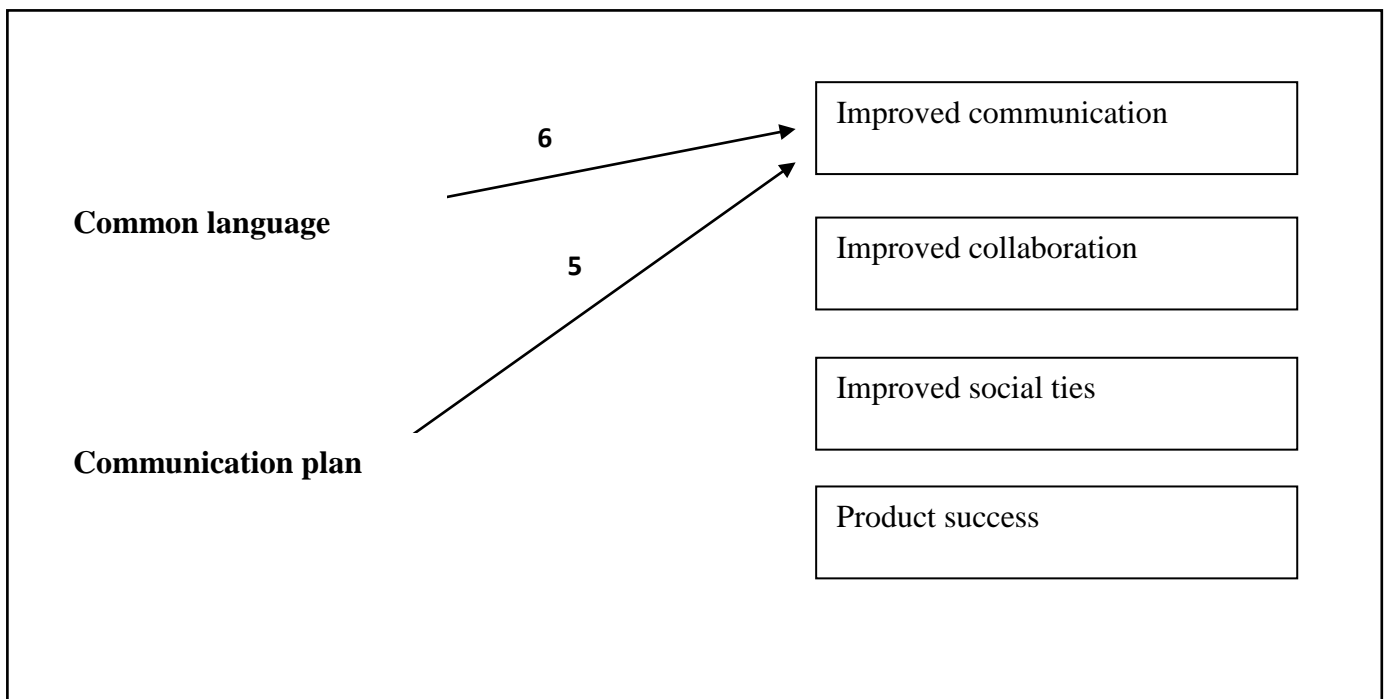
Communication rules

This practice was unique to case 3. Establishing communication rules was identified as essential for effective cross-site communication. This was in line with what has been prescribed in past studies on communication between virtual teams (Parvathanathan et al. 2007, Herbsleb, Grinter 1999, Markus, Manville & Agres 2014). Contrary to the majority of global software development studies that suggest that a high level of communication should be maintained across all sites (Robillard, Robillard 2000) we observed that in case 3, cross-site communication was done through one person only. This rule stated that cross-site communication should be done through one key person at each site, whose role was to communicate queries and issues to the other sites and communicate the answers to the rest of the team. Communication between the organisation and the customer was restricted to management only. This ensured that there was consistency in the information released to

customers and it also freed developers from this responsibility so that they can concentrate on their core task of developing software.

Figure 9 illustrates the relationships between the propositions associated with effective communication and the categories of success.

Figure 9: Effective communication



C. Tools and Technology

ICT infrastructure

We discovered that a reliable and high bandwidth ICT infrastructure is required to ensure connectivity between remote sites to make coordination between sites more effective and efficient, as Carmel and Agarwal (2006) also pointed out. Setting up an appropriate infrastructure was seen as a way to facilitate integration since it allows distributed development work to be brought together. Hence this reduces the impact of coordination breakdowns. We also discovered that the ICT infrastructure should meet the following requirements:

- **Fast internet:** Fast internet enables quick access to the network by all members in remote locations.

- **Extranet:** This helps to host a secure project management portal.
- **Screen-sharing tool:** This tool allows a developer to share a screen with a fellow developer in a remote location. Some of these tools even allow a remote team member to remotely control another computer.
- **Shared Database:** Having one central database accessible over a WAN from remote locations ensures that everyone is working with the latest versions of files and components.
- **Web access:** Web access is needed for web-based applications such as version-control systems which allow team members to share software artefacts in a monitored manner.

Project managers need to provide a wide variety of communication tools to distributed teams. In case 3, where temporal distance was an issue, an ICT infrastructure that supports asynchronous communication was provided. To ensure interoperability of cross-site operations, there is a need to provide common tools. Having access to appropriate ICT infrastructure does not guarantee that it will be used, but is essential for the successful operation of virtual teams. With proper training and motivation, a sophisticated ICT infrastructure can be effective to bring different locations together. Based on the findings, we formulated the following proposition:

Proposition 7

If the ICT infrastructure provides common ICT facilities for teams at distributed locations with proper training provided, then the ability of a distributed team to collaborate effectively and efficiently increases.

Cloud-based development tools

We discovered that the use of cloud-based development tools offers the developers in the organisation the same and standardised development tools and methods. This means that the programming languages and code editors will be the same across the development sites. This is vital to ensure interoperability of development tools across development sites and it also helps developers to share the code and ensure the quality of the process. This also ensures that different software components designed at different sites are compatible.

Cloud-based development tools enable the centralisation of tools under a single environment which is accessible from all remote locations over the Web, to ensure that everybody is working with the same most updated versions. This facilitates better collaboration between developers located at various different locations. Based on the findings, we formulated the following proposition:

Proposition 8

The use of cloud-based development tools ensures standardisation and centralisation of tools across locations. This improves coordination and helps project managers to easily monitor project progress.

Collaborative tools

We discovered that all three cases made use of a wide variety of collaborative tools. These include email, chat programs, phone, video chat and creating short videos. While it is important to have effective communication tools in place, it is also important to ensure that people are also motivated and equipped with the required knowledge.

The key issues that collaborative tools should address are to enable and facilitate communication within and among the distributed teams and to ensure that updated project artefacts are made available across the organisation. Herbsleb and Moitra (2001) stated that the key drivers for a communication and collaboration strategy are an increase of information availability and accessibility to all team members in a disciplined manner, as well as the creation of an environment of participation where all team members contribute to the information exchange. In support to these findings, we discovered that providing a variety of collaborative tools facilitates information sharing. In line with what Casey (2010a) suggests, we found that email was a necessary tool and the most appropriate method of communication in case 3, given the temporal distance between locations and the need for an effective asynchronous tool. In addition to that, team members based in the Middle East, as seen earlier, were not native English speakers, hence the use of email allowed them to use translation tools and an online dictionary. This helps to bridge language barriers. Furthermore, we found that email was also used to share calendars. This keeps the team informed of the public holidays of the remote locations.

As Casey (2010b) suggested, we also found that chat programs were used to convey issues that required a quick response. Also, many interviewees indicated that a chat program is

regarded as an informal way of communicating, hence making it possible to neglect communication etiquette such as correct spelling or grammar. This also enables team members to engage in informal communication that develops relationships and trust.

Collaborative tools also provide a platform through which team members can communicate the progress of the project to the project manager. Thus the project manager will be able to monitor and control the progress of the project. Collaborative tools, such as video chat, were viewed as an alternative to face-to-face meetings since it allows team members to see each other. It also helps team members to get to know one another as they are able to see each other's faces. That helped team members to get acquainted and develop relationships. Based on the findings, we formulated the following propositions:

Proposition 9a

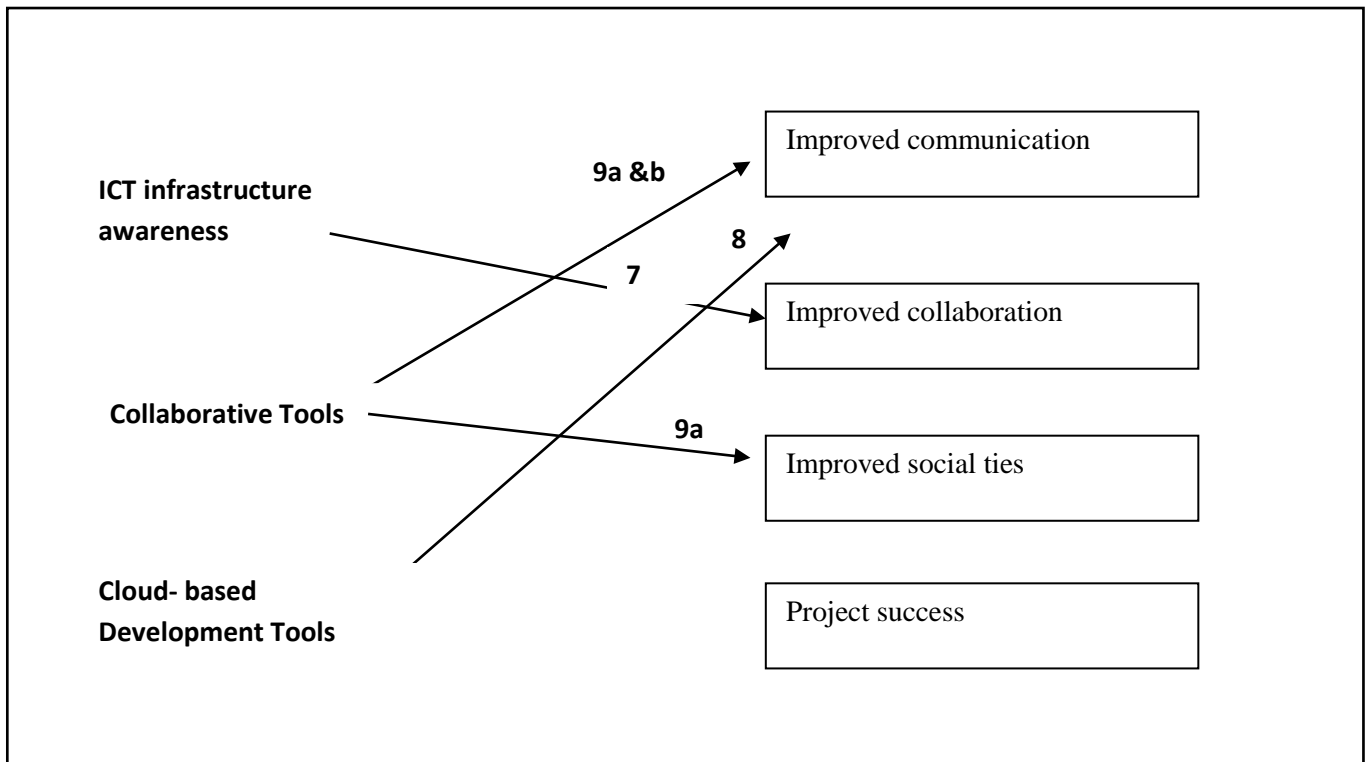
Providing a wide range of collaborative technologies for distributed members with proper training and motivation is more likely to increase the effectiveness of communication and help team members to develop relationships.

Proposition 9b

The use of asynchronous communication tools helps to bridge temporal distance.

Figure 10 illustrates the relationships between propositions associated with tools and technology and the categories of success.

Figure 10: Tools and technology



D. Project management

Planning

Data analysis of the three cases indicated that project planning was identified as important for the success of distributed software development. According to Martin (1991), the lack of proper planning can cause many problems in all the software development phases. Parvathanathan et al (2007) also stated that the planning phase is important to organise and manage the distributed projects more effectively. In order to ensure the success of project planning, we discovered that it is important to involve team members from all the sites in the planning sessions and all the team members should agree on the feasibility of the project plan. When all the team members are involved, they are more likely to be committed to the project. Based on the findings, we formulated the following proposition:

Proposition 10

Involving all team members in project planning is likely to increase team member commitment to the project.

Develop clear project objectives and success measures

Data analysis from the three cases show that developing clear project objectives is important for the success of virtual teams. Casey (2010b) pointed out that those objectives need to be understood and agreed to by all the team members regardless of the location. To achieve this, we discovered that in all three cases, all team members were involved in the planning meetings regardless of the location. For the objective to be a motivating factor, it needs to be measurable, attainable and specific. In line with what Colomo-Palacios et al (2014) stated, we found that setting clear objectives helps team members to remain focused on achieving project objectives. This ensures that the project vision is disseminated and that all team members in different locations are aligned to the project objectives. The performance of the teams needs to be measured against performance metrics. Project managers should create clear benchmarks and metrics that are used to track a team, updating the team progress virtually so that everyone can see the progress the team is making. Rewards should be based on the performance of the team and should be shared equally between locations. We also discovered that if rewards are to be given for good performance, the project managers need to take culture into consideration. Based on the findings we formulated the following proposition:

Proposition 11

Developing clear project plans which are measurable, attainabl, and specific are likely to positively influence the success in delivering project objectives.

Communicate the project plan and team progress

Many researchers reported that project visibility is negatively affected by geographical and temporal distances between remote locations. We found that communicating the project plan was considered important to ensure that everyone has a shared understanding of the project purpose process and the desired outcomes and artefacts. To achieve this, the project plans should be easily accessible to every member in the team. To alleviate geographical and temporal distance, it is important to make use of effective ICT tools, such as project management tracking tools and emails. Project management tracking tools create suitable metrics to provide useful information to keep everyone updated regarding the status of the project. Since a project planning document is a dynamic document, any changes need to be communicated to all the team members. Casey (2010a) pointed out that communicating the

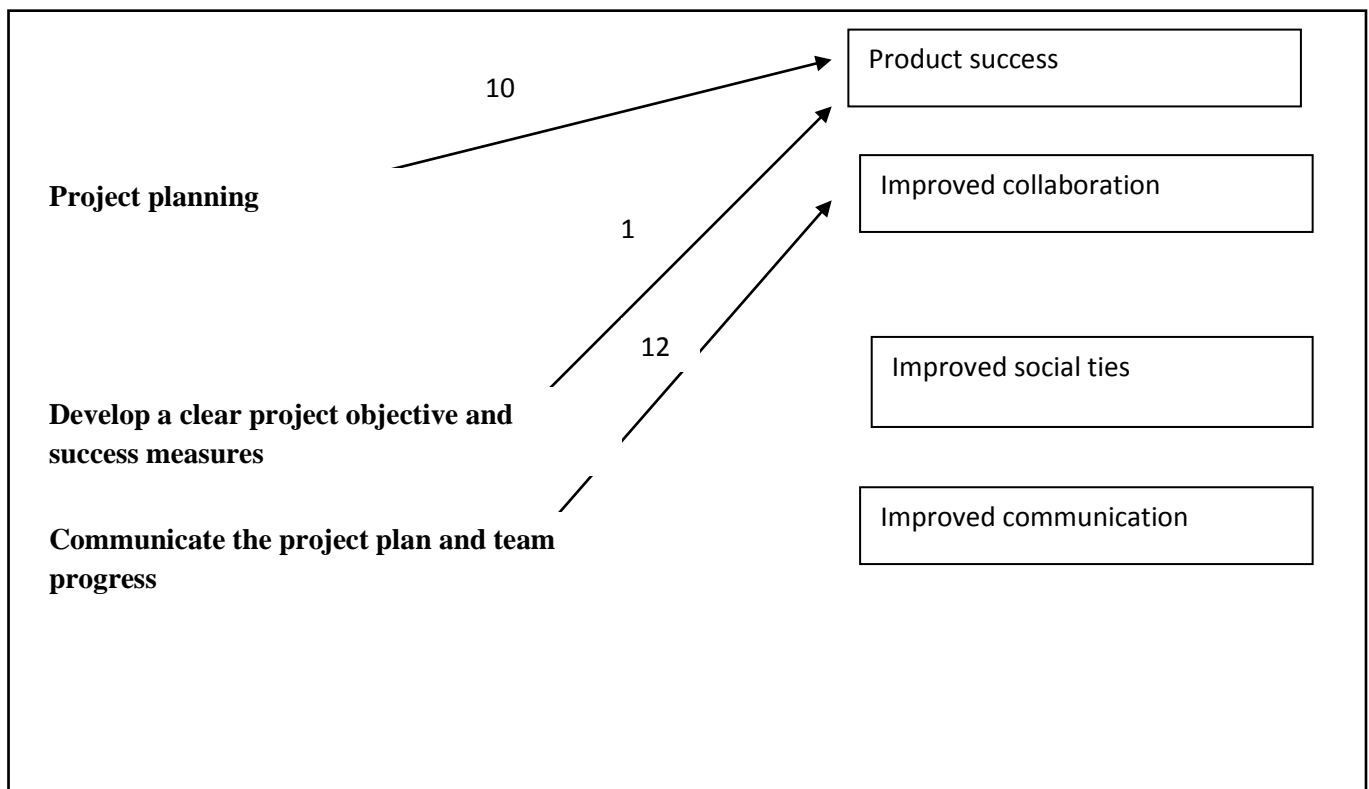
project plan not only promotes a shared understanding between team members, but also facilitates effective coordination and control and increases the likelihood of the project succeeding. This is because the project plan assists team members to determine what their roles involve and when, what, and how they are required to carry them out. Based on the findings, we formulated the following proposition:

Proposition 12

Communicating a project plan and team progress using ICT tools facilitates a shared understanding and is most likely to promote project coordination, increasing the chances of the project to succeed.

Figure 11 illustrates the relationship between propositions associated with project management and the categories of success.

Figure 11: Project management



5.2 Factors contributing to the success of GSD

Data analysis collected from the three case studies identified four factors that contributed to success in global software development, namely: cross-cultural collaboration, effective communication, tools and technology and effective project management. In order to assess the contribution of the potential factors to success, the analysis of individual cases included the mapping of instances in which explicit causal relationships were expressed by an interviewee between managerial practice and success (one of the categories of success). To compare results across cases, the results from individual cases illustrating the contribution of potential factors to success were integrated into table 10.

Table 10: Success factors

Factors	Measure of success			
	Improved communication	Improved collaboration	Improved social ties	Product success
Cross-cultural collaboration				
Case 1	+	+	+	
Case 2	+	+	+	
Case 3	+	+		
Effective communication				
Case 1	+		+	
Case 2	+	+	+	
Case 3	+			
Tools and technology				
Case 1	+	+	+	
Case 2	+	+	+	
Case 3	+	+	+	
Project management				
Case 1		+		+
Case 2		+		+
Case 3				+

5.3 Conclusion

This chapter presented the analysis of the findings of the three case studies. The findings were compared and contrasted with the existing literature. The factors perceived as important for the success of global software development were discussed and compared with the existing literature and propositions that suggest relationships between the factors and the categories of success were also formulated. The propositions formulated show the relationship between the factors and the measures of success. We identified four factors that were perceived as important in the management of global software development in the Middle East. These are cross-cultural collaboration, effective communication, tools and technology and effective project management. In the next chapter, the conclusions of this dissertation are presented.

CHAPTER 6: CONCLUSION

This chapter summarises the main findings and results of this dissertation and also presents the answers to the research questions. Section 6.1 reviews the research objectives. Section 6.2 outlines the proposed theoretical framework. Section 6.3 explains how companies in the Middle East organise and manage distributed software development projects. The role of context in selecting successful managerial practices for distributed software development projects is discussed in Section 6.4. Finally, practical contributions as a result of this research are discussed in section 6.5. This chapter concludes with the limitations of this study and suggestions for future research in section 6.6 and section 6.7 respectively.

6.1 Review of the research objective

The objective of this study was to develop a complete understanding of how to manage globally distributed development projects in the Middle East. While many studies have been carried out on the challenges faced in globally distributed software projects and the possible solutions, there is a lack of qualitative studies that concentrate on software companies in the Middle East. Research done in other countries cannot be applied to the Middle East because of the differences in culture and work ethics. This called for the need to conduct research focusing on software companies operating in the Middle East.

The main research question is:

RQ 1. How do companies in the Middle East successfully manage and organise software development in a globally distributed environment?

To answer this question, the following sub-questions were identified:

RQ 2. What factors contribute to the success of globally distributed software projects in the Middle East?

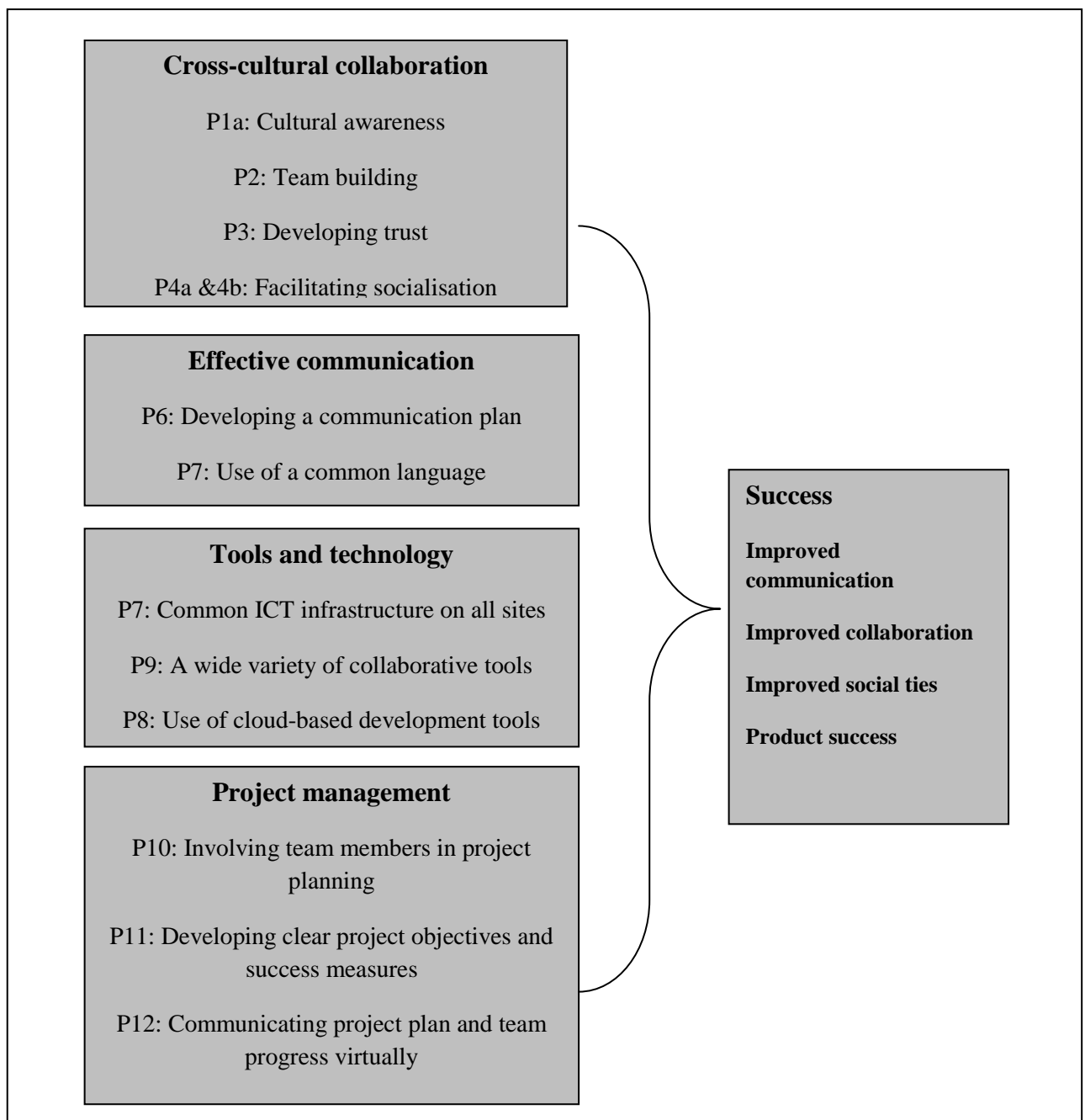
RQ 3 What are the best practices the globally distributed software development teams engage in order to ensure success of the project in the Middle East?

The next section answers the main research question.

6.2 Proposed theoretical framework of the management of virtual teams

We propose a theoretical framework of management based on the findings from the three studied cases. The proposed theoretical framework brings together the potential factors that were perceived as important to the management of virtual teams in the global distributed software development, and the propositions that focus on the relationship between each factor and project success which are presented in figure 12.

Figure 12: Proposed theoretical framework



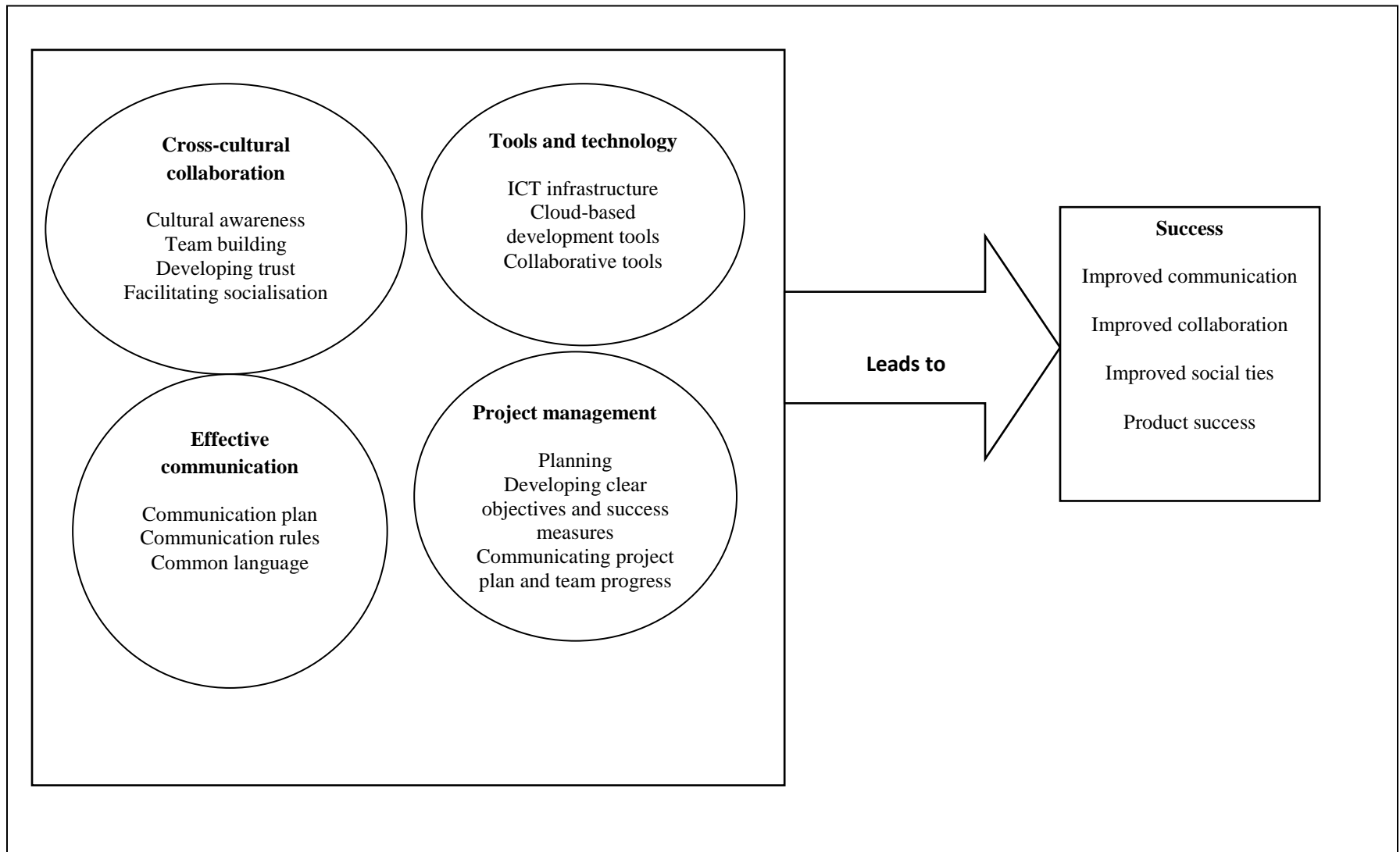
The theoretical framework presented in figure 12 shows that four factors, namely (i) cross-cultural collaboration, (ii) effective communication, (iii) tools and technology and (iv) project management contribute to the success of globally distributed software development projects in the Middle East. As shown in figure 12, propositions defined as a result of data analysis from the three cases (refer to Chapter 5) are incorporated in the proposed theoretical framework. The propositions suggest relationships between specific managerial practices and the success criteria.

6.3 How companies organise and manage globally distributed software development projects in the Middle East?

A total of thirteen factors were identified in the studied cases which contribute to the success of globally distributed software. The factors were categorised into different aspects of management of virtual teams in globally distributed software development projects. Figure 13 summarises the factors identified in all three cases. Some of the factors were identified in all three cases, where some were unique to case 3 only.

The managerial practices and factors presented in figure 13 answer the main research question, which is “*How do companies in the Middle East successfully manage and organise software development in a globally distributed environment?*”

Figure 13: How virtual teams are successfully managed in global distributed software development projects



6.4 Can the success factors identified apply to all the companies in the Middle East?

In this research, success factors and managerial practices that indicate how globally distributed software development projects are managed in the Middle East are identified. The success factors and practices identified in the three case studies resulted in successful project outcomes. Can the same factors be applied to a different company involved in globally distributed software development in the Middle East and be successful? Not all factors can be applied to globally distributed software development and expect to yield the same results. This is because each project is unique and there is a wide diversity of software development project types, domains, sizes and processes used, as well as the culture of the remote team. Thus, there is no guarantee that a practice used successfully in one project will even be considered a good practice in another project.

Therefore, contextual characteristics need to be taken into account when managers select managerial practices to adopt in globally distributed software development projects - practices that are successful in one company will not necessarily be successful in another organisation if specific contextual characteristics are different.

6.5 Practical contributions

The objective of this research was to identify the factors that influence the effectiveness of virtual teams in global software development projects in the Middle East. Our study revealed that managing distributed software development projects using virtual teams is a difficult task. For these projects to be successfully managed, several factors need to be considered. Cultural issues need to be addressed. Managers need to ensure that all members are aware of the cultural and religious differences that exist between members of different virtual teams. The predominant religion in the Middle East is Islam. Project managers are encouraged to respect prayer times of individual team members who are Muslims to avoid cultural clashes. If possible, prayer rooms should be provided, and scheduling meetings during prayer times should be avoided to ensure that everyone participates.

Our respondents highlighted that one of the prerequisites for global software development to succeed, is the use of a common language. All participating members in different locations should be proficient in the language chosen.

We also identified that having the necessary ICT infrastructure and tools to support remote site efforts is important. A good ICT infrastructure enables connection between remote teams. This includes physical connectivity, server configuration, applications, extranets, conferencing tools, as well as network speed and bandwidth.

Virtual teams involved in global software development should consider using cloud-based development tools, as this offers a standardised development platform. Project management techniques should be virtual in nature. The use of collaborative project management tools offers a project manager a web-based interface to manage project information for calendars and milestone tracking. This gives the project manager a crucial overview of the project status at different virtual locations.

The following presents a checklist for managers aiming to develop software in a globally distributed environment in the Middle East.

Checklist for managers of GSD in Middle East
1. Communication plan and communication process (Tick the action list)
1.1 Communication Plan Decide on the following <ul style="list-style-type: none"> <input type="checkbox"/> Official language to be used <input type="checkbox"/> Communication technology to be used <input type="checkbox"/> How the team progress is communicated <input type="checkbox"/> When to have a face-to face meeting <input type="checkbox"/> What training is needed for team members to effectively use communication technology <input type="checkbox"/> Training requirements needed by the team members to communicate fluently in the official language selected. 1.2 Communication process <ul style="list-style-type: none"> <input type="checkbox"/> Set communication rules <input type="checkbox"/> Set up a contact person for a remote team <input type="checkbox"/> Establish common vocabulary <input type="checkbox"/> Set up extensive English courses for team members <input type="checkbox"/> Facilitate socialisation among team members

<input type="checkbox"/> Use simple English to communicate <input type="checkbox"/> Use email to communicate where possible (team members can use translation tools to translate written text into their own language to understand better) <input type="checkbox"/> Set up face-to-face meetings <input type="checkbox"/> Incorporate team building activities
2 Cultural Issues (Tick the action list)
<input type="checkbox"/> Try to avoid setting meetings during prayer times <input type="checkbox"/> Provide prayer rooms <input type="checkbox"/> Avoid alcoholic beverages in a social gathering that involve Muslim team members <input type="checkbox"/> Carryout cultural training <input type="checkbox"/> Beware that some public holidays are unplanned because they are determined by the Hijri calendar (Islamic calendar) and the moon (e.g. Prophet Muhammad's Birthday, Islamic new year, Eid holiday). <input type="checkbox"/> Be aware of the fact that Muslim women are reserved <input type="checkbox"/> Creation of cross-cultural and mixed-gender teams need to be carefully monitored.
3 Building trust (tick the action list)
<input type="checkbox"/> Set up an initial face-to-face meeting <input type="checkbox"/> Make information regarding the technical ability of team members accessible to all location <input type="checkbox"/> Organise virtual team building exercises <input type="checkbox"/> Communicate project progress truthfully
4.Tools and Technology
ICT Infrastructure (provide the following capabilities) <input type="checkbox"/> Faster internet access <input type="checkbox"/> Screen-sharing tools <input type="checkbox"/> Extranets <input type="checkbox"/> A shared database <input type="checkbox"/> Web access <input type="checkbox"/> Cloud-based development tools <input type="checkbox"/> Email

<input type="checkbox"/> Chat program <input type="checkbox"/> Phone <input type="checkbox"/> Video conferencing
5 Project management (tick the action plan)
<input type="checkbox"/> Involve all the team members in planning <input type="checkbox"/> Develop project objectives and success measures <input type="checkbox"/> Communicate the project plan

6.6 Limitations

The purpose of the study was to gain an understanding of the management of distributed software development in the Middle East. Due to time and financial constraints, the researcher was only able to study three companies. The conclusions offered in this research were based on the views of participants from the three companies. These companies were based in Dubai, Oman and Abu Dhabi. This study the uniqueness of the companies, and project and team characteristics of the cases makes theoretical generalisation difficult. Conducting similar case studies that involve different countries in the Middle East such as Jordan and Saudi Arabia, may reveal new results unique to the specific culture of the region. Therefore, conducting more case studies across the Middle East involving different countries will enable researchers to test the proposed theoretical framework in different cultural settings and will extend the proposed set of managerial practices by including more culture-specific practices.

The findings of this research were obtained by applying a qualitative interpretive approach that is regarded as subjective and has limited generalisability (Myers, Newman 2007). The conclusions drawn were largely based on the perceptions of the participants, which may be subjective. To compensate for this subjective source of data, evidence was also collected from internal and external documentation and observation, which are considered to be more objective sources, in particular external reports as suggested by Yin (2013)

6.7 Suggestions for further research

The results of the research provide an insight into the factors that affect the management of global software development projects in the Middle East. A number of topics can be suggested for a future research agenda:

Firstly, future research can focus on the specific phases of the development process. One such phase that has received little attention, is requirement specifications.

Secondly, this research highlighted the importance of cultural awareness, such as religion, in the operation of distributed software development. The predominant religion in the Middle East is Islam. The effect of this on the operation of virtual teams and globally distributed software development warrants further investigation. It is hoped that this work will assist to highlight this important issue and provide the basis for additional research.

Finally, to further understand the management of distributed software development in the Middle East, research in different Middle Eastern countries and different types of globally distributed software development, such as Open Source Software development, is needed

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8: APPENDICES

Appendix A: Case 1

Background information of case 1

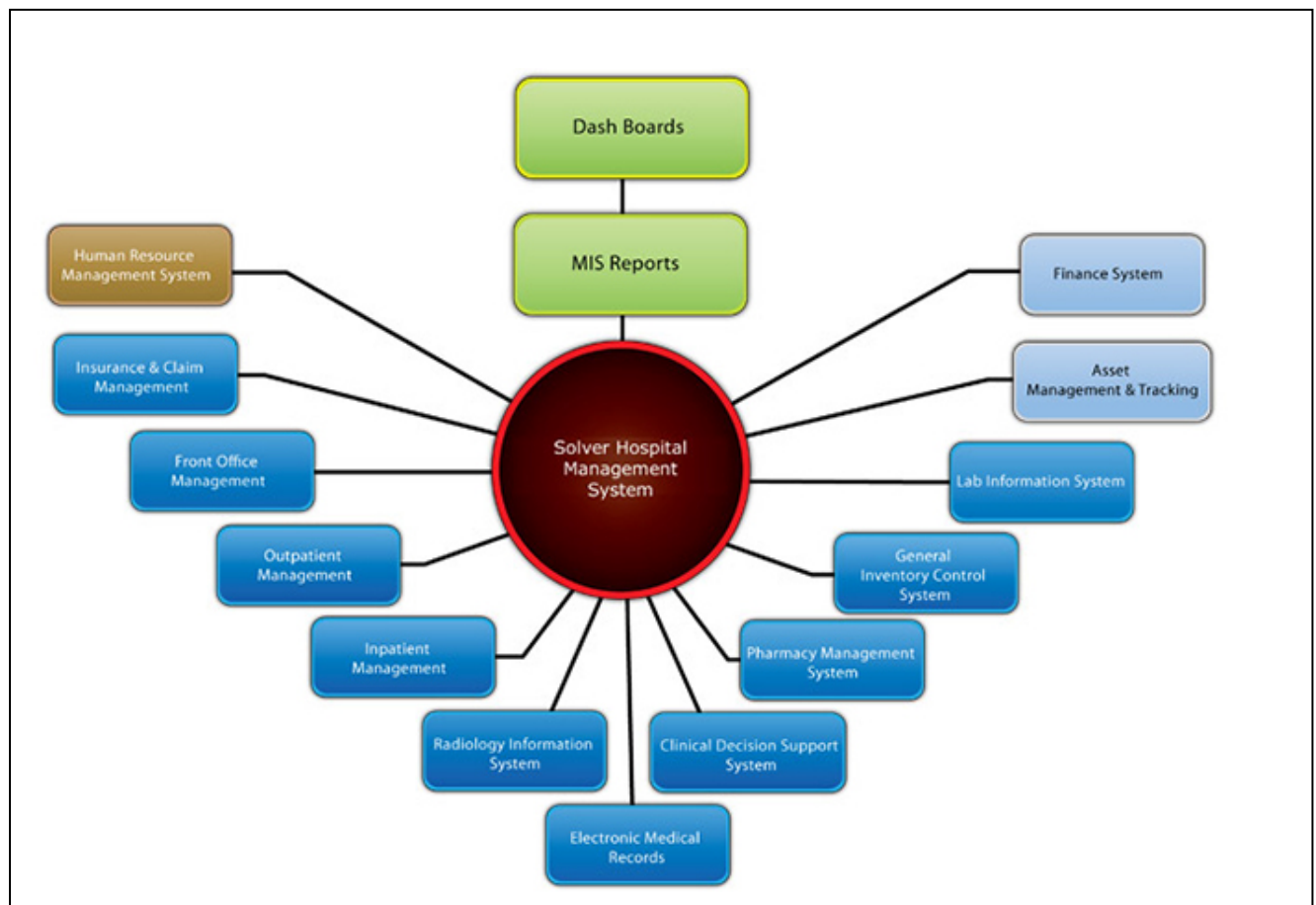
Case 1 was conducted in an organisation that carries out software and web application development across the Middle East. The aim was to develop a single-stop solution hub for the entire information technology requirements of the organisations. Over the past years of its software development journey, the company has concentrated on achieving excellence by implementing innovative technologies which enabled them to have a group of satisfied customers. Since its inception, the company has maintained a steady growth amidst severe competition in the international market. The company added a range of products that it believes are world class and user friendly in order to retain its market leadership in the GCCs countries and India. In a bid to provide a better service to the market, the company decided to open development centres in different countries. The main sites are in Abu Dhabi, Muscat (Oman) and the headquarters is based in India.

Background of the project and product under study

The project investigated in this case study concerns the development of an integrated hospital management system. The system was designed to manage workflow processes across the healthcare enterprise which includes managing medical, administrative, financial and legal aspects.

The system was developed in Microsoft Visual Studio with a Microsoft SQL Server as a backend database. The system complies with international health-standard practices such as the WHO standard for disease diagnosis by a physician and health level 7 (a framework and standard for the healthcare industry provided by ANSI). The following diagram summaries the functionalities that the system provides to the users

Figure 14: Functionalities of the integrated hospital management system of case 1



Background of the software team

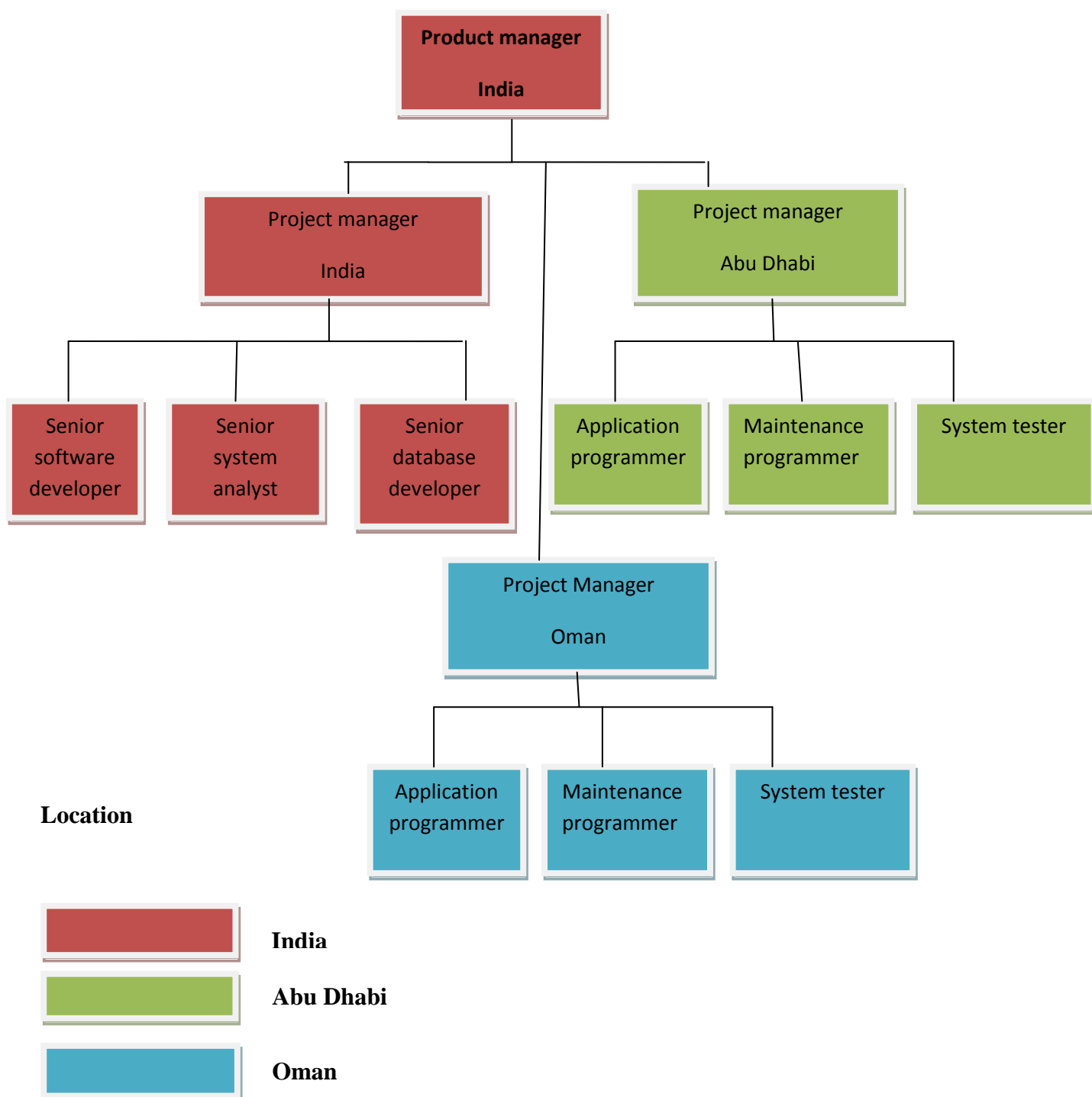
Working experience in globally distributed development environment

The development team in Abu Dhabi is a relatively young group. Some of the people have been involved in a globally distributed environment in other projects. One of the recruitment policies of the company is to recruit developers that have prior experience working in a globally distributed environment. The rest of the development team that is based in India is made up of senior developers with the majority having more than 5 years working experience.

Organisational structure of the software development team

The group was organised by team function. The following diagram shows the organisational structure of the development team.

Figure 15: Organisational structures of the development teams of case 1



The software team is distributed between three locations namely:

1. India (Head office with 10 Software engineers)
2. Abu Dhabi (6 Software developers)
3. Oman, Muscat (3 software developers)

Data Collected

Data was collected from a number of sources:

1. Interviews
2. Document review – project document as well as company documents
3. Observation in Abu Dhabi office where I spent 5 days
4. Information conversation with managers

Table 11 summarises the roles of the people interviewed and the locations where the interviews took place.

Table 11: Case 1 Interview and Data collection Details

Role	Location	Interview and other communication details for data communication purposes
Project manager	Abu Dhabi	Interview at Abu Dhabi office on December 17 2013 Document review from 17 December 2013 to 21 December 2013 <ul style="list-style-type: none"> • Follow-up by email with clarifications and additional information • Review and comments on the draft of the case study report • Phone interview on November 15 2013 • Follow-up by email with clarifications and additional information
Senior software developer	India	Phone interview on November 15 2013 <ul style="list-style-type: none"> • Follow-up by email with clarifications and additional information
System analyst	Abu Dhabi	<ul style="list-style-type: none"> • Several informal conversations from November - December 2013 • Review and comments on the draft of the case study report • Phone interview on November 15, 2013 • Follow-up by email with clarifications and regarding additional internal and external material
Programmer	Abu Dhabi	<ul style="list-style-type: none"> • Several informal conversations in November and December 2013 • Review and comments on the draft of the case study report • Phone interview on November 15, 2013 • Follow-up by email with clarifications and regarding additional internal and external material
Business aystemanalyst	Abu Dhabi	<ul style="list-style-type: none"> • Several informal conversations in November and December 2013 • Review and comments on the draft of the case study report • Phone interview on November 15, 2013 • Follow-up by email with clarifications and regarding additional internal and external material

In addition to interviews and document reviews, I also spent several days observing how the software team based in Abu Dhabi and Oman operated.

Appendix B: Case 2

Background information of Case 2

Case 2 involved a software development company that operates across the Middle East and Pakistan. The company have development sites in India, Pakistan and Oman with all three sites being managed and controlled by the main branch in Pakistan. The manager in Pakistan manages the software engineering group which consist of 50 people distributed across three sites.

It develops a variety of specialised solutions customised to GCC. Those solutions were designed to cater for ever-changing business requirements.

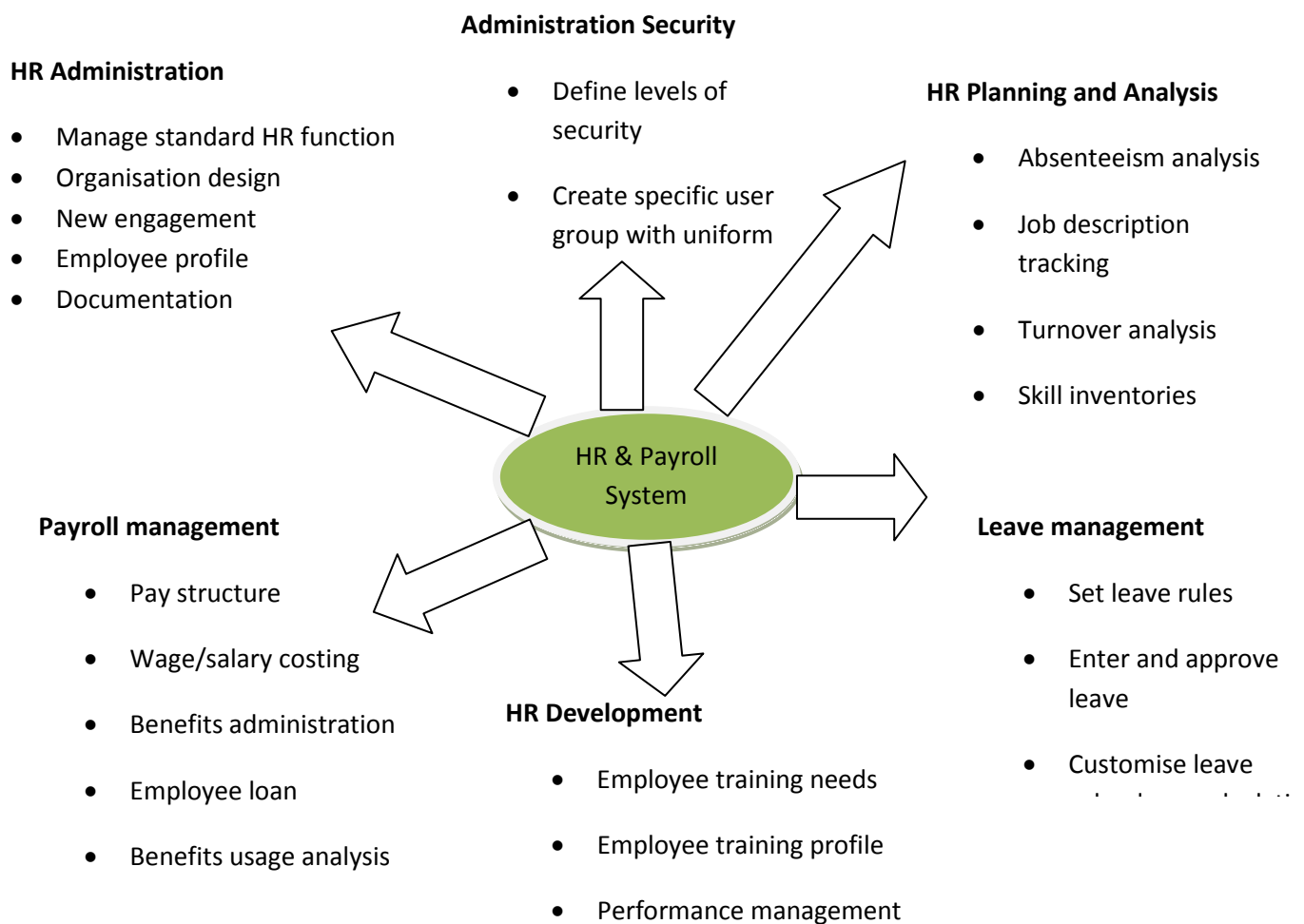
The company was registered in Oman in 1999. The main objective is to deliver quality solutions and friendly, professional service to enhance the competitive advantage of its customers.

Background of project and product under study

This case study concerns the development and implementation of a human resource and payroll system. The system can interface with most financial, as well as time and attendance systems to provide a paperless and automated solution to human resources and payroll.

The following is a summary of the functionalities of the human resources and payroll system:

Figure 16: Functionalities of HR & Payroll project of case 2



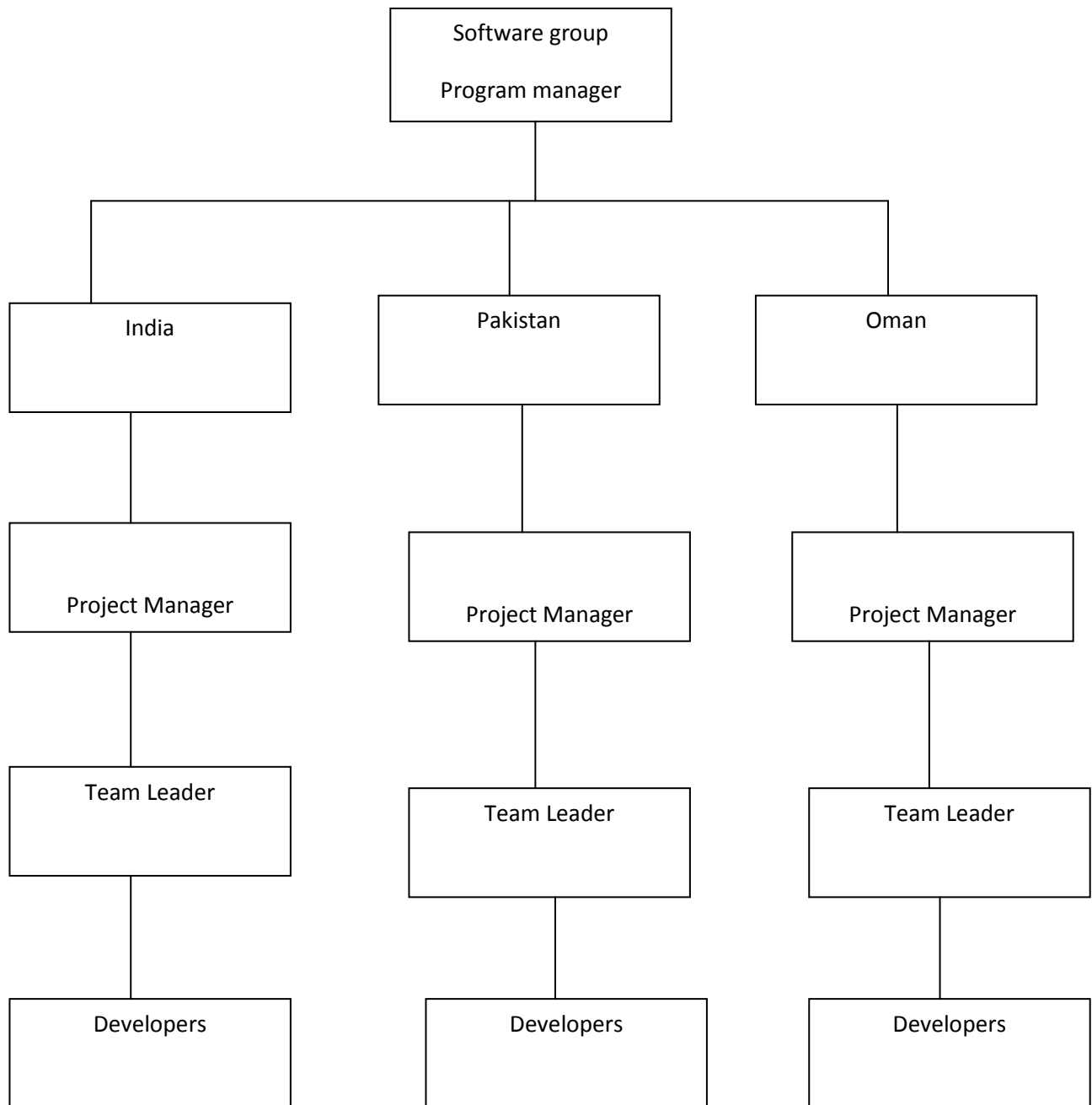
Background of the software team

Working experience in globally distributed development environment

From 1999, when the company formed a site in Oman, all software development was done in a globally distributed environment that included at least two locations: a customer site and the main development site in Pakistan.

It recently formed another development site in India mainly because of a large and relatively inexpensive pool of IT experts in India. Thus the Oman team where the study was conducted was used to working in a globally distributed environment.

Figure 17: Organisation structure of case 2 development team



Data Collected

Data was collected from a number of sources:

- Interviews
- Document review – project documents as well as company documents
- Observation
- Information conversation with managers

The following table summarises the roles of the people interviewed and the locations where the interviews took place.

Table 12: Case 2 Interview and Data collection Details

Role	Location	Interview and other communication details for data communication purposes
Project manager	Oman	Interview at Dubai office on 1 January 2014 • Follow-up by email with clarifications and additional information • Review and comments on the draft of the case study report • Phone interview on 5 January 2014 • Follow-up by email with clarifications and additional information
Senior software developer	Pakistan	Phone interview on 6 January 2014 • Follow-up by email with clarifications and additional information
Tester	Oman	• Several informal conversations in December 2013 and January 2014 • Review and comments on the draft of the case study report • Phone interview on 15 January 2014 • Follow-up by email with clarifications and regarding additional internal and external material
Programmer	Oman	• Several informal conversations in December 2013 and January 2014 • Review and comments on the draft of the case study report • Phone interview on 20 January 2014 • Follow-up by email with clarifications and regarding additional internal and external material
Tester	Oman	• Phone interview on 15 December 2013 • Several informal conversations in December 2013 and January 2014 • Review and comments on the draft of the case study report • Follow-up by email with clarifications and regarding additional internal and external material

Appendix C: Case 3

Background information of Case 3

Case 3 is a company that was established in 2000 in Dubai. Its main headquarters is based in the USA. This company decided to form sites in Dubai and Oman mainly because of an increasing number of customers in the Middle East. Much of the work done in the Middle East depends on the colleagues in USA. The software development work done in Dubai is controlled and coordinated by the team in the USA.

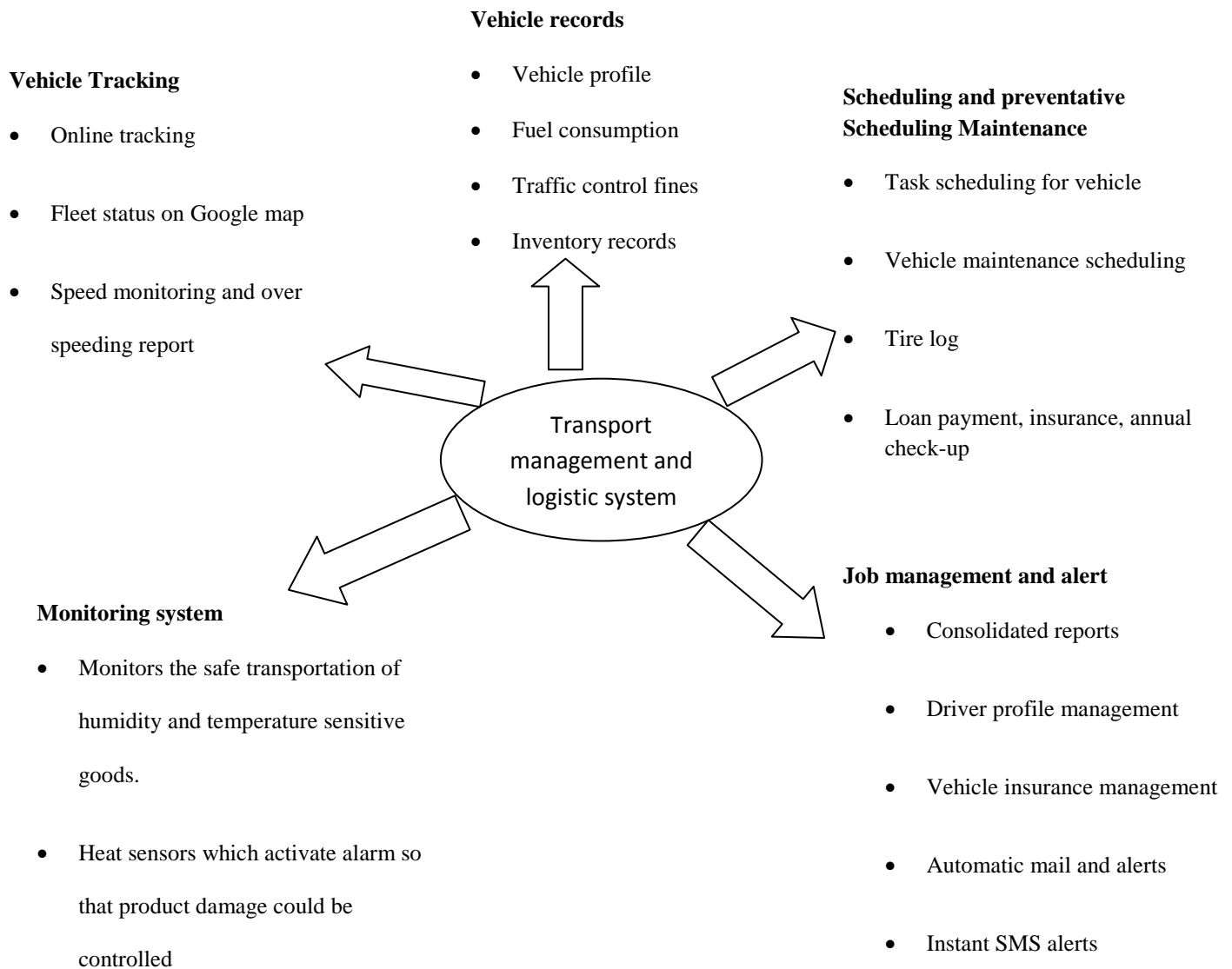
The company mainly develops and implements business applications solutions across the Middle East. The company has implemented a number of projects for both the private and public sectors ranging from software development to document management & archiving deployment to (enterprise resource planning (ERP) implementation.

During the time the case study was conducted, the company was reorganising its development centres. They decided to close development work in Oman. The company decided to partner with one of the leading ERP solution providers in the Middle East that implements Oracle E-Business Suite, including financials, (human resource management systems (HRMS), distribution and manufacturing. Although this case study does not fit the unit of analysis and case selection criteria, its inclusion in this research gives us the chance to compare success factors and managerial practices from successful projects of cases 1 and 2 with practices that were not implemented in the unsuccessful project of case 3.

Background of the project and product under study

The project investigated in this case study concerns the development of a transport management system. The system was designed to manage the workflow processes across the transport department, which includes managing vehicle records and maintains registrations, fuel consumption, preventative maintenance scheduling, tire tracking, insurance, inventory control, traffic control fines, along with all the required data to provide all information required to monitor and control transport divisions in organisations. The functionalities offered by the transport management system are presented in figure 16.

Figure 18: Functionalities of Transport Management and logistic system of case 3



At the time of this study, the development of a tracking and logistic software project involved two main geographical locations: an offshore team in Dubai and an onsite team in the USA. The software development work done in Dubai was controlled and coordinated by the team in the USA. The team in Dubai was mainly responsible for customising the software to suit Middle Eastern needs.

Background of the software team

Working experience in globally distributed development environment

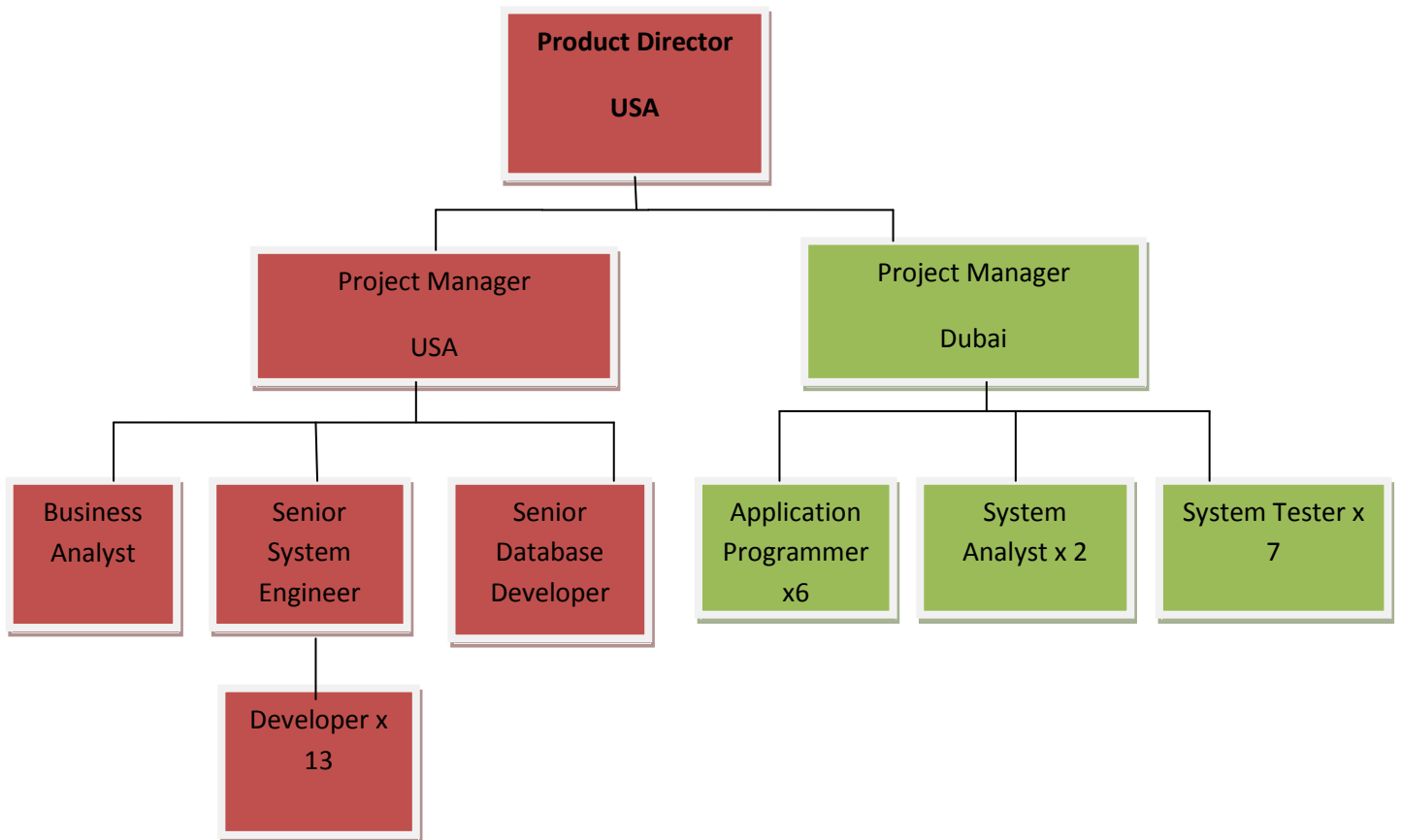
Since the company was situated in Dubai, the development work was distributed between the USA and Dubai. The team in Dubai consisted of a small number of software developers and testers mainly responsible for changing the language of the user interface of the system to Arabic and customising the solution to suit the Middle East market. According to the interviewees in Dubai, the Dubai team has extensive experience in developing business solutions in a distributed context.

The team based in the USA was the larger and was mainly responsible for carrying out user requirements and software development. With the growing market in the Middle East, the company decided to increase the size of the team based in the Middle East and also to increase their responsibilities. The company felt that if they have a stronger development team closer to the market, it will help to serve the market efficiently and effectively.

Organisational structure of the software development team

The project organisational structure of transport management and logistic implementation consists of an *on-site* team in the USA and *offshore* teams in Dubai close to the customers. The following diagram shows the organisational structure of the development team.

Figure 19: Organisational structure of development team in case 3



Data Collected

Data

- Interviews
- Document reviews – project documents as well as company documents
- Observation in the Dubai office for 2 days
- Information conversation with managers
- Informal conversation with development teams
- Telephone interviews with the USA team

The roles of the people interviewed and the locations where the interviews took place are summarised in table 13.

Table 13: Case 3 Interview and Data collection Details

Role	Location	Interview and other communication detail for data communication purposes
Project manager	Dubai	Interview at Dubai office on 1 January 2013 <ul style="list-style-type: none"> • Follow-up by email with clarifications and additional information • Review and comments on the draft of the case study report • Phone interview on 5 January 2014 • Follow-up by email with clarifications and additional information
Senior software developer	USA	Phone interview on 6 January 2014 <ul style="list-style-type: none"> • Follow-up by email with clarifications and additional information
Tester	Dubai	<ul style="list-style-type: none"> • Several informal conversations in November and December 2013 • Review and comments on the draft of the case study report • Phone interview on 22 December 2013 • Follow-up by email with clarifications and regarding additional internal and external material
Programmer	Dubai	<ul style="list-style-type: none"> • Several informal conversations in November and December 2013 • Review and comments on the draft of the case study report • Phone interview on 15 November 2013 • Follow-up by email with clarifications and regarding additional internal and external material
Tester	Dubai	<ul style="list-style-type: none"> • Several informal conversations in November and December 2013 • Review and comments on the draft of the case study report • Phone interview on November 15 2013 • Follow-up by email with clarifications and regarding additional internal and external material

Appendix D. Interview Guideline

Title: Managing globally distributed software development projects using virtual teams: Middle East case study.

Interview aims: To understand how companies in the Middle East successfully manage and organise software development in a globally distributed environment and to identify the factors that contribute to the success of globally distributed software projects in the Middle East.

Respondents: Project managers, systems analysts, developers and testers.

1. Introduction

- a. How long have you been employed by the company you are currently working for?
- b. What is your position?
- c. What is your job description?
- d. Describe your role in relation to the rest of the organisation.
- e. What does your work mainly consist of?
- f. To what extent does your work deal with distributed software development?

2. Challenges and best practices in a globally distributed software development (GSD) environment

- a. What, do you think, are the difference between a co-located software development environment and a globally distributed software development environment?
- b. What challenges do you see arising from working in a distributed software development environment?
- c. What are the measures taken to address those challenges?
- d. What is your impression of effective project management?
- e. Do you think project managers of GSD projects need special skills?
- f. If so, what skills do they need?
- g. What do you understand by the term risk management?
- h. What are the risks involved in managing a distributed software development project which are not likely to be faced by co-located software development teams?
- i. What, do you think, are the mitigation measures that can be taken to reduce those risks?
- j. What, you do think, is the best management model for managing virtual teams?
- k. To what extent, do you think, project managers are effectively managing virtual teams to fully benefit from them?
- l. How, do you think, can, the level of motivation of teams in a Global Software Development (GSD) be increased?
- m. How would you deal with the following challenges while implementing your projects?
 - Cultural differences

- Language barriers
- Time zone differences

3. Tools used for managing distributed software development projects

- a. What tool do you use to communicate with other remote groups?
- b. How effective are those tools?
- c. How are remote team activities coordinated?

4. Conclusion

- a. Upon reflection of this conversation, what is your impression of GSD with respect to the management of software development projects?
- b. What lessons have you learned in dealing with GSDs in general?