

**ADDIS ABABA UNIVERSITY
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COLLEGE OF NATURAL SCIENCE
DEPARTMENT OF INFORMATION SCIENCE**

**Critical Success Factors In Mobile Application Development At Selected
Companies In Addis Ababa, Ethiopia**

BY

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This is to certify that the thesis prepared by Ayda Girmaye, entitled: Critical Success Factors in Mobile Application Development at Selected companies in Addis Ababa, Ethiopia and submitted in partial fulfillment of the requirements for the Degree of Master of Information Science complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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LIST OF ABBREVIATION

API	Application Program Interfaces
APPS	Applications
D&D	Drag and Drop
DIA	Data Interpretive Analysis
DTMF	Dual Tone Multi Frequency
EDA	Enterprise Digital Assistant
GPRS	General Packet Radio Service
IOS	iphone Operating System
IT	Information Technology
LLC	Limited Liability Company
MAD	Mobile Application Development
MIT	Massachusetts Institute of Technology
MMS	Multi Media Message Service
NFC	Near Field Communication
OS	Operator System
PDA	Personal Digital Assistant
PLC	Private Limited Company
SDK	System Development kit
SMS	Short Message Service

ABSTRACT

These days, Mobile application development is one of the most critical business sectors in the world. Mostly the development companies are applying this business sector widely. Not only this, but in some developing countries like in Ethiopia can also be observed. Mobile application plays a very big advantage for individuals, groups, organizations and also for country. We can say that Mobile Application Development is a problem solver, entertaining and also a way of revenue generation for the country. But in our case, since we are developing country, Governments' didn't give that much attention for this business sector and the governments' rule and regulation is somehow restricted and also it assumed as a cause for security problems. For this reason companies are discouraged to develop new MAD company. So it needs more attention in order to gain high revenue and to make life easier. Beside, for whom that participated in this sector, it is very important to consider the critical success factors that allows developing better Mobile Application.

The aim of this study is to identify the critical success factors of Mobile Application Development in Addis Ababa, Ethiopia. Specifically in three selected companies. These are Approbatics IT PLC, Techno Mobiles and Apposite LLC. This thesis is a descriptive research which is concerning on describing about Mobile application development success factors and it gives introduction since it is a new research done in Ethiopia. It allows organization to gain knowledge of critical success factors of Mobile Application Development for appropriate management and to use mobile application in their domain. In other case, for Application developers, it shows the important factors during the development process and allows them to complete their duty timely. In general, this thesis answers the research question by identifying the critical success factors of MAD in order to use and for appropriate management, which is helpful to have good understanding about Mobile Application Development success factors also.

The necessary data is collected using questionnaire and interview from three Mobile Application Development companies to get an overall picture of the area and analyze using statistical techniques and from the result the researcher categorize the critical success factors in to three. Namely: Organizational Factors, Technological Factors and Employee Factors then additionally failure factors were directed.

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND

Mobile application is one of the most important parts of Information Technology and the use of information technology has become persistent in the management of organizations in all sectors of mobile economy, and it is difficult to imagine any organizations to be competitive without using computer applications [1].

In recent years, the dynamic expansion of Mobile applications and devices cause for huge economic, potential and cultural changes and the effects can be seen in area such as healthcare, education, business and the public sectors and it's not only a regional phenomenon but also it is a global trend [1]. Different Companies are spending much of their time and revenues on information technology to cop up with the changing business world [2]. This means mobile application development is now one of the largest corporate expenses.

In a modern IT age mobile application is one of the most concerned and rapidly developing areas and running on mobile environment which is a small hand hold mobile device, movable, easy to use and accessible from any were and any place and so many people are using mobile application to contact friends, browse internet, file content management, document creation and handling, entertainment etc [3]. Moreover, mobile application usedfor calling, messaging, browsing, chatting, social network communication, audio, video, game and so on, from any were, users can get facility of mobile application. Not only mobile application has impact for users but also it plays an important role in business also. Therefore, many business companies are earning revenue using mobile application [3].

Mobile application development is the set of processes and procedures involved in writing software for small, wireless computing devices such as smart phones or tablets [4]. Mobile application development is similar to web application development and has its roots in more traditional software development. As the author describes in article [4], there are two types of

mobile applications that can be accessed by wireless devices, the browser-based or web based or an application that is accessed through the use of the mobile device's web browser coded using mark-up language and native applications or an applications that are found entirely on the mobile device. The benefit of native applications are easy low- level hardware access services, easy to high level service, important to personal mobile experience, full use of all functionalities that modern mobile devises have to offer, and high usability [4].

Mobile applications also referred to as mobile apps, which are software applications that are usually designed to be ran on smart phones and tablet computers [5]. A wireless mobile application is defined as a software application, a wireless service or a mobile service that can be either pushed to users' handheld wireless devices or downloaded and installed on the devices [6].

A variety of different platforms emerged and developers are developing applications. An important issue for the application developer is to decide which platforms help to support mobile development. Currently, there are five important platforms are available such as: iPhone, Android, BlackBerry, Windows Phone and Symbian [4].

There are several major trends that contribute to the increase of using mobile applications. These are the increased availability and options to Internet connection for mobile devices, the shift to the new mobile environments for the business applications, cloud application's development, and the new research findings that identifies new technologies and the performance of mobile device and others allowed mobile devices to become available for a wider variety of users [6].

Moreover, developing mobile applications represents major changes in both technical skill sets and in the approach in order to balance functionality and usability [7]. Therefore, Application developers must be aware of the critical success factors before developing mobile application. This includes: understanding that designing for simplicity and usability are the key factors, and choosing an appropriate deployment method such as, platform-independent html5 or platform-dependent native coding, understanding mobile security issues including portals, getaways, mobile virtual private networks and one-time password, determining the user base for each mobile OS, following established governance, path to production, and deployment models [7].

In our context, even though, the use of mobile application is significantly important for business, for making organization to gain competitive advantage, it is not broadly applied in our country Ethiopia, but organization like Commercial bank of Ethiopia, CBE, is applying mobile application technology in there domain. So, CBE uses mobile application technology and it is possible to mention the company's product as mobile banking technology. This mobile banking technology allows users to know the amount of money, to transfer and reactive money without having account book and physical contact to the bank. This technology is helpful for faster and reliable utilization.

The same is true for the other organization in Ethiopia called Ethiopian Power Corporation; this organization is using mobile application technology for billing purpose. Previously users were paying their bill by having physical contact with the employees in the organization. But now, thanks to mobile application technology, they can use the technology in easy way and diverse manual system is now avoiding.

In other case, most MAD companies in Ethiopia don't provide training for the developers. For this reason developers are trying to develop mobile application based on their personal knowledge. For this case it is so important to give training for the developers in order to develop better application and to broad their level of understanding during the development process. In other case Most of the employees in MAD are male than female so lack of female participation is observed.

As a challenge, companies are not yet knowledgeable about the use of mobile application development, so then they are still using manual system instead of automated system or mobile application technology. Also both organizations and government didn't give attention. For this reason, it's preferable to give attention for this business sector in order to gain high revenue, to solve problems and to make life easier. This study focused on identifying the critical success factor for Mobile Application Development to use and for appropriate management.

1.2. STATEMENT OF THE PROBLEM

Mobile application has gained a lot of attention both in research and industry over the last years and the market share is constantly growing and more users expect their mobile application to provide functionality similar to the known desktop computers, and a mobile device specific functionality like location based service. However, software development for mobile devices is still neglected and a methodology gathered towards supporting the development of such mobile application is still lacking [5].

Mobile application development is a significant business sector in different countries including Ethiopia but it is not procedurally well known and manageably used. “As mobile applications become more complex and mission critical, development organizations must introduce processes that address more aspects of the development process that are covered in today’s agile processes and development environments” [2]. Most of the time, the organizations got crisis due to improper usage of resource. For this reason, for the organizations that deal with this business sector, it is very important to adopt the important issues or critical success factors before starting the development process for proper usage and management. This will help the business sectors in many ways.

Even though there are good descriptions of the mobile application development, a structured description of success factors and potential problems is still missing, to identify success factors and issues of current mobile technology implementations a multiple case study in the area of mobile technologies is needed” [3].

Furthermore, though there are efforts in studying factors affecting software development. But in general, there is scarcity on the mobile application development successes [3]. Also many studies were explore about mobile application development process and most of the studies are concerned for the experimental and designing issues and it’s possible to generalize that, the critical success factor of mobile application development has not obtained much attention [3].

Moreover, even though there are studies that identify the success factors of mobile application, those the way of identification factors were not well organized and classified based on their similarity, but in this study critical factors are categorized based on their similarity. Beside there is no research undertaken on identifying critical success factors of Mobile Application Development in Ethiopia. Hence, this study aims to identify the critical success factors of MAD for appropriate management. Accordingly, this research study attempt to answer the following research question:

- What are the major and critical success factors of mobile application development in some selected MAD companies in Addis Ababa, Ethiopia?

1.3. OBJECTIVE OF THE STUDY

1.3.1. General Objective

The main objective of the study is to identify the critical success factors of mobile application development for appropriate management.

1.3.2. Specific Objective

Specifically, the research addresses the following areas.

- To identify the critical success factors in Mobile Application Development.
- To identify the associated factors for mobile application development success.

1.4. SIGNIFICANCE OF THE STUDY

The significance of the study can be seen in different aspects. One is in the developers' perspective; this research will help the developers to broaden their view of understanding about the mobile application important factors. In researchers' perspective, this study can be used as a reference to find out more on mobile application success. Moreover, in organizations' perspective, this study will show the success factors and critical issues for the MAD so that organization can identify the issues accordingly and can use this study as a guideline in order to be profitable, competent and preferable in the business sector. In users' perspective, the study

also has social contribution, since companies identify the factors based on the end users needs, it will increase user's satisfaction and solve different social problems.

Even though there are efforts in studying factors affecting software development, there is scarcity on the Mobile Application Development successes [3]. So, this study is focused on assessing the different success factors in development of mobile application, specifically in Ethiopia. Based on the identified factors, the researcher categorizes critical success factors of Mobile MAD in order to have a required understanding and used for appropriate management. So that, organizations can uses it effectively to gain competitive advantage, to understand its customer well and to produce a better product.

Generally, the critical success factors in MAD triggers the important issues that can be raise during the Development process and for mobile application usage. And it allow organizations to apply Mobile Application in there domain. So that, companies become more competent in the business world.

1.5.SCOPE AND LIMITATION OF THE STUDY

1.5.1. Scope

This study is focused on describing about the critical success factors of mobile application development excluding the experimental issues, which are applying in some mobile application development companies found in Addis Ababa, Ethiopia. The researcher tried to connect with Mobile Application developer's team and managers. Since, it is difficult to incorporate all mobile application development companies in the city to investigate the issues, beside, due to shortage of time, limited budget, the study focuses on three Mobile Application Companies like APROBATICS, APPOSIT and TECHNO MOBILES.

1.5.2. Limitation

As a limitation, since it is a new research area it needs a lot of time. Also there is a scarcity of mobile application companies and application developers in the country. If it was sufficiently available it would have been much better to gain more information about the current situation of MAD status in Ethiopia. For this reason the researcher insist to collect data from small number of mobile application developers and managers. Generally, the limitations are as follows:

- Time constraints of some interview and survey respondent's due to busy office work
- Small population in the area of mobile application development sector.
- Limited availability and access to studies done about Mobile Application Development successes. If it was available it would have been better to see a lot about the success of mobile application development.
- Limited access to get known official Mobile Application Company in Addis Ababa, Ethiopia during company selection due to lack of specification of the companies.

1.6. ORGANIZATION OF THE THESIS

This thesis report is arranging in five chapters. The first chapter starts with a general introduction about Mobile Application Development. It explains the research objective and research problems, the need or significance of the research, its scope and limitations. Chapter two detail with literature review about Mobile Application Development and its critical success factors. The third chapter discuss in detail about the methodology of the research, data collection and analysis techniques. Chapter four is about analyzing data, discuss and evaluation of results. Finally chapter five contains conclusion and recommendations for further works.

CHAPTER TWO

LITRATURE REVIEW

In this chapter the researcher reviewed an Overview of Mobile application, Mobile application development Trend, Approaches in MAD, MAD tools, MAD framework and designing process, Application area of Mobile application, Success factors and Challenges In mobile application development and finally different related works Were described and summarized using table.

2.1. OVERVIEW OF MOBILE APPLICATION DEVELOPMENT

In the modern age of IT system, people are using computer and computer applications for their day to day activity in order to make life easier and to solve problems. Though, Mobile Application uses and development is new and rapidly growing sector [3]. These days, global positive impacts of mobile application are observed. Using mobile application, developed countries are becoming facilitated and people of developing country are promoting themselves and making a new type of IT infrastructure [3].

Mobile application development is the set of processes and procedures involved in writing software for small, wireless computing devices such as smart phones or tablets and Mobile applications run in a mobile environment which usability depends on several factors such as: Screen resolution, Hardware limitations, Expensive Data Usage, Connectivity issues, Limited Interaction possibilities [3]. There has been highly growth in mobile application development since the iPhone AppStore opened in July, 2008 and Device makers have created outlet for other mobile devices, including different platforms such as; Android, BlackBerry, Nokia Ovi, Windows Phone. And as the writer describes, industry analysts estimated that there were more than 250,000 applications available through the various stores and marketplaces, some of which are available for multiple types of devices [3].

Mobile applications are a set of program that runs on a mobile device and perform certain tasks for the user. Also, Mobile applications are easy, user friendly, inexpensive, downloadable and run able in most of the mobile phones which is used for vast functioning area like calling, messaging, browsing, chatting, social network communication, audio, video, game and so on [3].

2.2. TRENDS OF MOBILE APPLICATION DEVELOPMENT

Trends in mobile application are categorized into three according to the literature discussed in [8], over the past few years, it is observed that the relatively stable market has evolved in three distinct directions. First, there seems to be a strong trend towards portal centralization, second there are an increased number of actors providing open source technology and finally, platforms are moving towards a higher level of integration.

- **Towards portal centralization**

As the preceding to the introduction of Apple's AppStore and more recently Google's Android Market, platforms did not have a central portal. With the introduction of its AppStore, Apple made mobile application market not to be underestimated and represent an important revenue stream [8].



Fig 2.1 Portal trends [8]]

- **Towards technological openness (open source)**

The transition phase from a closed to an open architecture is cause for the future success of the platform. Among the major mobile platforms, LiMo used to be the only player in the open source field. Nokia has also moved in this direction after acquiring Symbian OS, Google has also followed this trend [8].

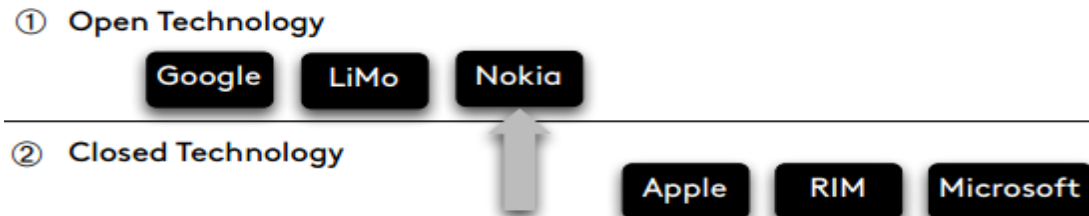


Fig 2.2 Technological trends [8]]

- **Towards full integration**

The other trend is the emergence of more integrated platforms, as shown in Figure 2.3. Before the introduction of Apple's platform, there was no fully integrated mobile platform. Moreover, as the author describes, there was no platform with portal integration before the introduction of Google's platform and Symbian OS is an example of the trend towards integration since it started as a platform with no integration, before it was integrated by Nokia to become a device integrated platform and finally, it became fully integrated. RIM is also expected to soon become fully integrated with the introduction of its Application Center. Furthermore, with Microsoft moving towards portal integration there will be no major platform left without integration [8].

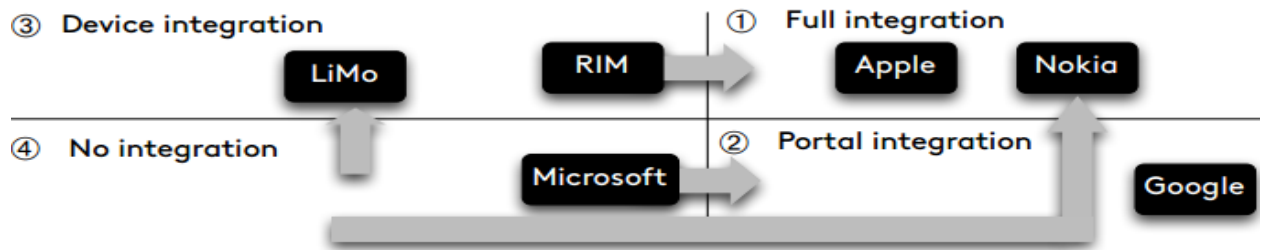


Fig 2.3 Integration trends [8]]

2.2.1. Approaches in Mobile Application Development

The literatures reveal that there are three approaches in mobile application development, the native application, web application and the hybrid approach as it described below.

Native application

A mobile native application is defined as an application specifically developed to execute on a specific device platform and cannot be used for other device Platform without modifications like for example, apps developed for the iPhone run only on Apple devices, hence, to use native apps, users must download them from app store and install them manually on their phones [6].

Web application

This kind of application are certain kinds of internet enabled application which developed using web standard technologies such as; HTML, CSS, JavaScript, and accessed by the mobile device's web browser and do not need to be downloaded and installed on the device. Moreover, Mobile Web application is a good paradigm to deliver information and service to mobile phone and also enables information processing functions to be initiated remotely on Web server [6].

Hybrid approach

There are third approach for mobile application development is the hybrid approach. It consists on creating a native application that instantiates a browser from which a web application is loaded. Using this approach, it is possible to have access to all the device resources, and it is not complex to create a different version of it for each platform [6].

2.2.2. Mobile Application Development Tools

The accessibility of various kinds of tools allows SW developers to generate the task of the mobile application development from its early stage to its growing stage. There are many well-known tools of mobile application. Among those tools, these are well known, Cross-platform mobile development tools, such as Rhodes, PhoneGap, DragonRad and MoSync [9].

Cross-platform mobile development tools are gaining popularity in the world because of their characteristic to compile the application source code for multiple supported OS's and those tools are mainly depending on web programming languages like HTML, JavaScript and CSS for accessing native API like Camera, Contacts, etc. [9]. The applications are easy and time saving with these tools like for example, DragonRad is providing Drag and Drop (D&D) features, which require reduced programming skills to develop applications [9].

Rhodes

The other tool is Rhodes 3.3.3 and as the writer explains in article [14], it is a cross-platform mobile application tool developed by Motorola Solutions under Massachusetts Institute of Technology. It is developed to rapidly build native applications for all major mobile OS's like iOS, Android, BlackBerry, Windows Mobile/Phone and Symbian. The main goal of Rhodes is to

provide a high level of productivity and portability in programming. It is an open source Ruby-based mobile development environment and Rhodes provides native device applications to improve the end-user experience, which work with synchronized local data and take advantage of device capabilities, like Barcode, Bluetooth, Calendar, Camera, Contacts, GPS, Menu, Near Field Communication, Screen Rotation, etc. [14].

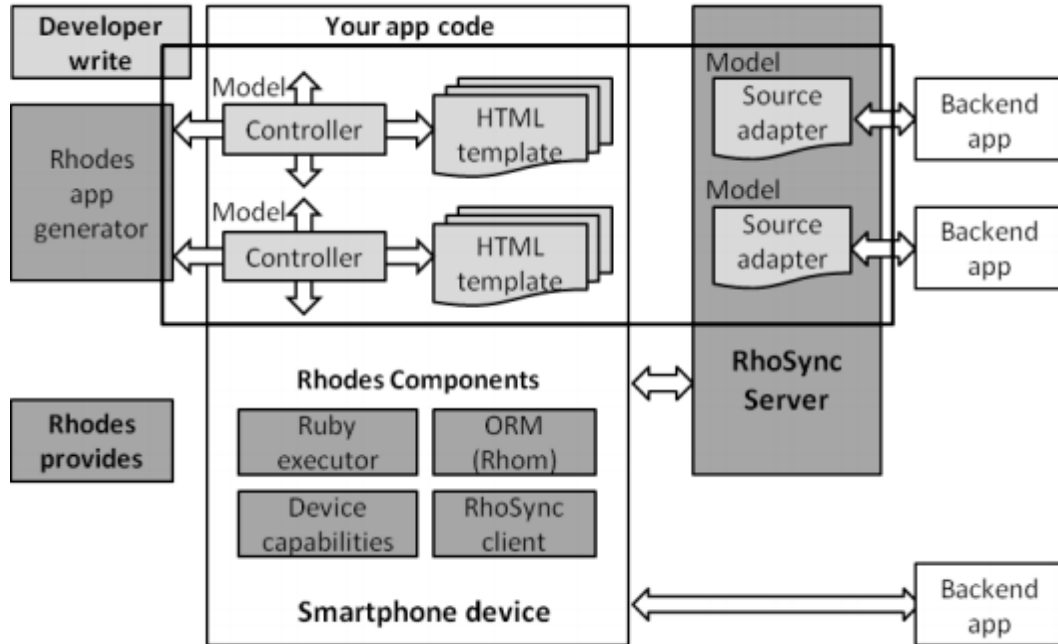


Fig 2.4 Rhodes interfacing architecture [9]]

PhoneGap

PhoneGap 1.9.0 is an open-source mobile development tool developed by Adobe System. Under Apache 2.0 license and PhoneGap allows developers and companies to build free, commercial and open-source applications, and give them also the possibility to use any licenses combination [8]. The development environment is cross-platform created which is created for Android, Bada, BlackBerry, iOS, Symbian, web OS and Windows Phone OS's. Moreover, PhoneGap applications are hybrid, which means that they are not purely native or web-based [9].

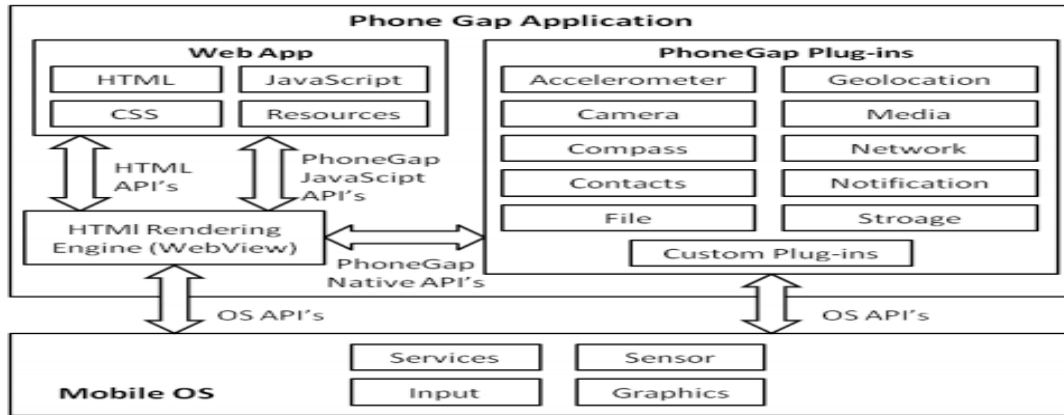


Fig 2.5 Phonegap Architecture and Interfacing among Components [9]]

Dragon Red

DragonRad 5.0 is a cross-platform mobile application development platform by Seregon Solutions. DragonRad has host-client architecture, it is required to setup server and Database based on the needs of developers but it also comes in complete package with all prerequisites of server and database like Tomcat, MySQL etc. and it is a commercial tool which supports language D&D, the possibilities of Extension in terms of adding plugins and other support to the Frameworks are quite limited [9]. Moreover, DragonRad facilitates the integration and synchronization of database system with native functions of the above OS's, like Contacts, Calendar, Geo location, Menu and Storage. The Architecture of Dragon Rad mainly composed of three major components [9]:

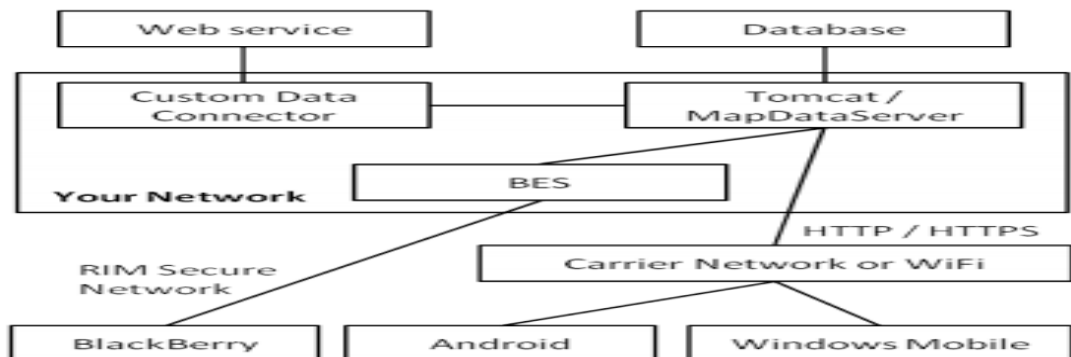


Fig 2.6 DragonRad architecture [9]]

MOSYNC

The forth tool is MoSync 4.0. As the author describes in [9], it is an open source solution developed by a Swedish company targeted to mobile market and has fully fledged SDK to help developers during build and package all types of mobile applications, like simple, advanced and complex application that share the same code base. Moreover, MoSync SDK provide very powerful tool with many Components together like Libraries, Runtimes, Device Profile Database and Compilers, and so on so it provides the full fledge Eclipse-based IDE and the use of standard C/C++ also it support web-based language like HTML, HTML5, CSS and JavaScript [9].

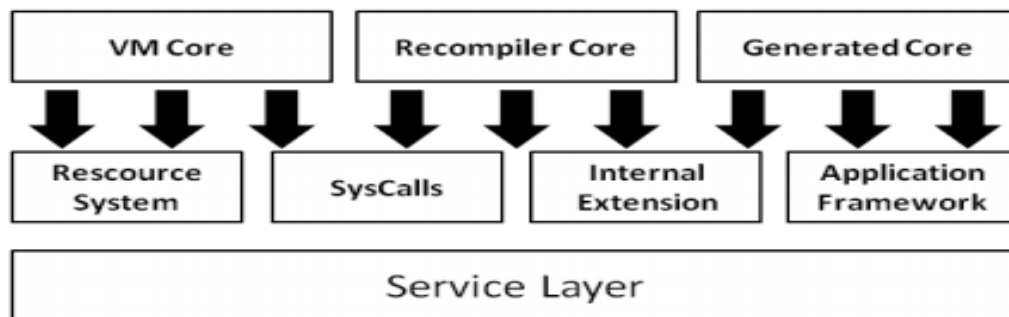


Fig 2.7 MoSync runtime architecture [9]]

As a summary the following tables shows the comparison of the different tools for Mobile Application Development.

Tool Name	Mobile OS Support	OS Support
Rhodes	Android, BlackBerry, iOS, Symbian, Windows Mobile, Windows Phone	Linux, Mac, Windows
PhoneGap	Android, BlackBerry, iOS, Symbian, WebOS, Windows Phone	Linux, Mac, Windows
DragonRad	Android, BlackBerry, iOS, Windows Mobile	Linux, Mac, Windows
MoSync	Android, iOS, BlackBerry, JavaME, Symbian, Windows Mobile	Linux, Mac, Windows,

Table 2.1Comparisons on Mobile Platforms Compatibility [9]]

2.3. MOBILE APPLICATION DEVELOPMENT FRAMEWORK AND DESIGNING PROCESS

2.3.1. Mobile Application Development Framework

Mobile application development framework is designed to sketch the development options and providing guidance on choosing which options and approaches to use, also encourage use of a governance process, deliver the technical IT building blocks required, and provide structure and assistance in using those building blocks [7]. By using the framework different projects can better adhere to standards and best practices, helping to deploy applications faster and thereby helping to increase business velocity.

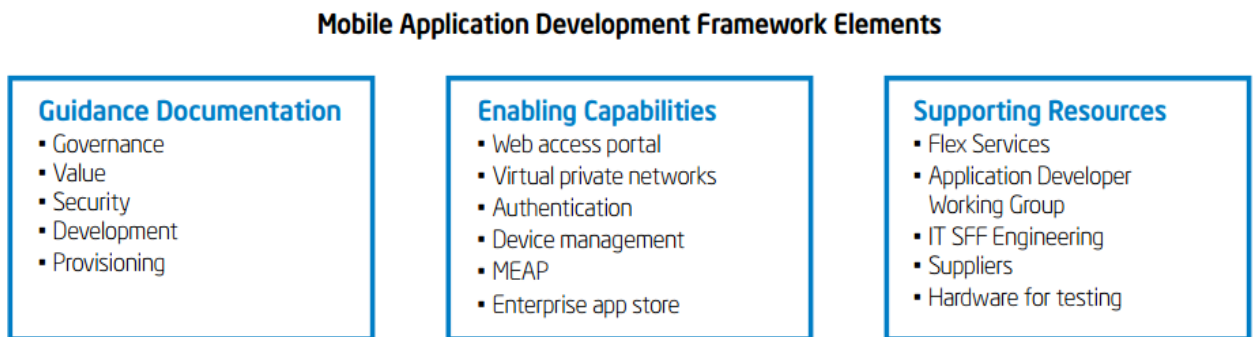


Fig 2.8 Mobile application framework elements [7]

As smart phone and tablet sales keep on to raise, Mobile computing will become the future of business. “Just as the personal computer revolutionized the era of smart phones and tablets will forever change the business landscape” [5] .The first step in creating mobile applications is a basic understanding of different options of different approaches which discussed above . Mobile applications come in two approaches, one is Native applications and the other is mobile web applications. Intel IT created a mobile application development framework a set of specific capabilities, tools, and resources that together enable mobile applications to be successfully planned, developed, and delivered into production.

The above framework enhance Intel’s existing approach to IT projects and standards to fully support the development of mobile applications [7]. Now with mobile application development framework, Intel’s development teams can more easily accomplish the following:

- Evaluate the suitability of mobile applications for mobile use cases
- Follow governance standards
- Identify the correct project deliverables for mobile deployment

The framework includes a decision matrix that explores questions relating to application content, existing user base, use cases, and costs and the matrix helps application developers to establish the business value of mobile development [7]. After completing the framework, Intel IT deployed a number of mobile enterprise applications, including customer relationship management, social media, travel tools, and a paystub application. Currently, development and deployment of several more applications are observed such as online collaboration and document sharing, factory worker applications, facility services, and expense reporting. Developing mobile applications represents major changes in both technical skill sets and in the approach in order to balancing functionality and usability [7].

2.3. MOBILE APPLICATION DEVELOPMENT DESIGNING PROCESS

2.3.1. Mobile Application Development Designing process

One of the crucial thing that mobile application developers needs to consider before initiating an apps is designing process, whether or not using a frame work. As the author describe about designing process, any application has its own designing process, like for example, designing application for iPhone is different than designing for android [6].

Application developers must be aware of the following; differences between mobile OSs, able to perform cross-platform development with ease, and adept at developing for varying screen resolutions and taking advantage of device-specific features such as device sensors and touch screens, while adhering to mobile standards [7]. Other areas of consideration during application development are: Understanding that designing for simplicity and usability are key factors, choosing an appropriate application deployment method, such as platform-independent HTML5 or platform-dependent native coding. Understanding mobile security issues include portals, gateways, mobile virtual private networks (VPNs), and one-time passwords [7].

2.3.1.1. Questions Must Be Answered Before Creating Mobile Applications

In order to choose the appropriate app type for any business, 5 questions should be answered before creating mobile applications [10]:

How many platforms do you need to support: -there are 4 main Smart phone platforms: such as iOS, Android, Windows Phone 7 and Blackberry OS Additionally, there are 4 main tablet platforms like iOS, Android, Blackberry OS and Windows 8. If cross-platform compatibility is a concern for a business, mobile web apps are a better choice as they are completely platform independent [10].

Do you need to use hardware sensors: -Native apps have access to device's hardware sensors, such as the camera and microphone, while mobile web apps can access certain sensors, like GPS, accelerometer, and gyroscope, they cannot access the camera. If you need a business app that uses these sensors, native apps are better choices [10]

How important is security: -“Mobile computing biggest advantage, portability, is also its biggest weakness, Since tablets and smart phones are so portable, they are also more likely to get lost or stolen” [10]. Native mobile apps that access important data could pose a security risk. Since native apps store data on the device itself, a lost or stolen device could lead to a security violation. On the other hand, mobile web apps store data in a centralized location, not on the device itself. In this case, a lost or stolen phone doesn't pose a security risk as no data is stored on the device itself [10].

What's the purpose of your app: -Mobile business applications generally serve one of three purposes: internal use, customer use, or revenue generation. If anybody building apps for customer use, both application options are suitable. However, to selling apps first it should be build native apps and place them in each platform's application store [10].

How important is data integration: -“Will your apps access your database and integrate into your current systems: If your apps are accessing business data then integration is crucial” [10]. If data integration is important, mobile web apps are a better choice [10].

2.3.1.2. Requirements to create mobile Application

As it described in the article [10], Requirements are vary depending on the app format. Here are the requirements for creating both native and mobile web apps. In case of Native apps, Developers: it needs a developer familiar with the mobile platform programming language. Most platforms use different programming languages. Here are the programming languages required to create native apps for the most popular mobile operating systems such as: - Android - Java, Blackberry - Java, iOS - Objective-C and Windows Phone 7 - C# , Join the developer program: also it needs to join the developer programs for every platform. Each one requires a small entry fee. The other point is Team; it needs a team together to maintain these native apps. Whenever a mobile platform releases a new update, it needs to update the application [10].

In case of Web app Web designer, it needs someone who is familiar with HTML, CSS, and JavaScript. And also Web developer: If you want full web apps that connect to a back-end database and include business logic, web developer is important [10]. Unlike native apps, no limitof using development language and possible to build mobile apps in whatever language like Java, PHP, Python, etc...

Generally, Mobile computing is the future of business. To create mobile apps for business, two options can be seen; Create native apps or mobile web apps [10]. To summarize the information detailed above, here are 5 important factors that will impact mobile application decision, If we want apps that work across multiple platforms, mobile web apps are a better option, If we want apps that access the device's camera or microphone, native apps are better, If security is important, mobile web apps are a better option , If we want to sell your apps, native apps are a better option, If we want apps that integrate with existing systems and databases, mobile web apps are a better option [10] . For a company plans on creating mobile apps the above factors will help a lot.

2.4. APPLICATION AREA FOR MOBILE APPLICATION

2.4.1. MOBILE APPLICATION'S EFFECT IN BUSINESS

Within last few years, smartphone and mobile application uses growth rate is high, so mobile application has a great positive impact on Business [3]. There are different areas of business where mobile applications play an important role:

Business of Mobile Internet Broadband: All of the smart phone and feature phone have smart environment and vast number of mobile application and Most of the applications are connect people to the world via mobile Internet broadband. Like for example, Google map navigation, email, entertainment, gaming, m-Commerce etc. [3].

Mobile Application Development Business: These means Some Specialize development companies develop user friendly software in which user can customize for doing their own work like share with friends also those software uses for video game or any entertainment [3]. If users use different software, the user will promote the software more and the company will earn more.

Business using Mobile application is the following such as Face book, YouTube, Twitter, Skype and other software's [3]. All over the world so many people are using those software and the providers are earning revenue and also Business Promotion or Advertising are using Mobile application so Mobile application publisher, distributor and service provider are getting large revenue by providing mobile applications and the advantage of advertising in mobile application depends on the popularity of application or uses frequency of that application [3].

Mobile Application Market: Different mobile operating system has provided by different mobile company. And for those mobile, most of the mobile company has own mobile application market Such as, iPhone application market, BlackBerry application market, Android market etc. From those online markets, users can download many useful mobile applications. Some applications are free or provided by company and some user has to pay for downloading. In every year a large number of mobile application downloaded by mobile user [3]. So this is a big business sector. In this business sector mobile manufacturer company as well as network operators or mobile application developer companies are earning huge amount of money. Also for downloading those

software the smartphone user are using the mobile internet. Not only the mobile application but also the user downloads game, music and other entertainment material [3].

2.4.2. MOBILE APPLICATION'S EFFECT IN SOCIETY

Mobile application has also a great effect in society other than individuals or business. As the author describe in the article [3]. The whole society can be facilitating using mobile application. Some issues are described as bellow:

- Quick communication: Some mobile application like Facebook, Twitter, Messenger, Skype, Google Talk is helps the society for communication one another. They can stay in touch where the geographical distance is not a factor. So the social relation improves and make strong. And this is good for family, friend and society [3].
- Save time and increase productivity: In different countries people can do their daily work like check email, contact with business partner from any time in bus, car or walk. So, no need to wait in room or office. In this way save the time and people can get more time to work [3].
- Improve IT infrastructure in developing country: In developing country the uses of mobile application improve the knowledge of people because, they are accessing Internet from everywhere. As a result the IT infrastructure improves in any developing country [3].
- Increase Job vacancy: The mobile application development and mobile application business make more job vacancy available in society. So many people can get job in this field. This is also good for society and country.
- Less computer use less power consumption: When most of the people will use mobile application for their daily simple work and getting facility from mobile application, the computer uses will be less as well as the power consumption will be less.
- Considerable Cost Saving: Mobile VoIP application can help people to making international call from mobile. As a result the monthly expenditure reduced.
- Entertainment: Using mobile application people in society can entertained themselves. There are so many other social effect issues which all are ethically good for the society

According to application area, these are different categories in which a Mobile Application applied for as it describes in the article.

- **Communications:** Internet browsing, email IM client, Social Networking,
- **Games:** Puzzle/ Strategy, Cards /Casino, Action/ Adventure,
- **Multimedia:** Graphics /Image viewer, Presentations viewers, Video Players, Audio players,
- **Productivity:** Calendars, Calculators, Diary, Notepad /Memo/Word Processors, Spreadsheets,
- **Travel:** City guide, Currency converter, Translators, GPS/Maps, Itineraries / Schedules , Weather
- **Utilities:** Profile manager, Idle screen/Screen saver, Address book, Task manager, Call manager, File manager

2.5. SUCCESS FACTORS OF MOBILE APPLICATION DEVELOPMENT

Identifying the critical success factors for mobile application development is one of the most significant things before starting to develop mobile application in order to be profitable and competitive in today's business sector and also to increase user satisfaction. Ensuring that the application meets more than one of the success factors will stack the chances of the application succeeding and this are entertainment factor, usability factor, utility factor, functionality factors and maintenance factors [11]. Based on the above factors it is possible to analyze the successes and failures of a number of branded mobile applications.

The success of mobile application was depending on some list of qualities. Among those, most relevant for mobile applications were performance or efficient use of device resources, responsiveness, and scalability, reliability, which are robustness, connectivity, and stability, quality which is usability and instability and also security [2].

In other case, the success of mobile field service implementations was affected by the implementation strategy, project management, change management, and technological restrictions of the used mobile technology [12].

The most important criteria of rating mobile applications is entertainment factors. The app should be clever enough to catch the user's attention and the best example of a branded application that was developed for entertaining and clever is the Virtual Zippo Lighter app and the app contains

an image of a lighter that opens and turns on while holding an iPhone, and was primarily marketed to live music fan. As evidence of the near-perfect union of entertainment factor, inventive use of technology, and brand experience, the Zippo app landed in the Top 20 downloaded list than app store within the first year of its launch [11].

Beyond entertainment value, brands have the opportunity to use an application to provide a valuable utility and Utility factor is important for mobile marketing, as it allow users to continue to interact with an application long after the entertainment value. This factor mainly deal with how helpful is the application [11].

Functionality is the other factor in mobile application. Mobile applications should not simply replicate a website instead mobile apps should take advantage of all the inherent features and functionality of the mobile device, such as GPS, camera, and motion sensor [11]. In case of Maintenance, an application should be considered a long-term investment with a lifecycle almost as long as the average branded website. This means regular updates should be factored into a broad maintenance plan [11].

In other case, Mobile Gaming is one of mobile entertainment application and it is expected to become highly popular and portable [17]. As it discussed above, the importance of mobile application development can be categorized as, communication: video, calling, mobile education, SMS, MMS; Information: for advertising product, scheduling; Transactions: mobile banking, finance, peer to peer payment; Entertainment: ringtones, mobile games, video, adult entertainment, music.

The Factors that affect mobile game application are identified as follows: In case of business: Compatibility, facilitating conditions or payment option and trial ability. In case of infrastructure: Accessibility, saving time, fun, usefulness, simplicity, interactive and innovation, culture, age, attribute to new technology, cost, technical and economic environment, privacy and security risk efficiency, complexity, relative advantages, communicability, entertain images, and social acceptance. Those factors directly affect mobile application development in one or another way [17].

As a general, the success of Mobile Application Development is influenced by the following factors namely: implementation strategy, Project management, Change management, Technological restrictions of the used Mobile technology, Complexity of technological components and their limitation, User acceptance, entertainment factor, usability factor, utility factor, functionality factors and maintenance factors. In other case, Quality Security, Reliability and Performance, Culture, Age, Compatibility, Simplicity, Social acceptances are assumed as critical factors [7].

2.7. RELATED WORKES

In this section related work about mobile application development is described. Knowing the methodology they follow, experimental result and findings are contribute a lot as an input for this thesis.

Though there are good descriptions of the application development, a structured description of success factors and potential problems is still missing. To identify success factors and issues of current mobile technology implementations a multiple case study in the area of mobile technologies is needed. The goal of this literature was to analyses implementation strategies and critical success factors of successful mobile field service applications comparing different cases in one study. And also compare the different success factors between mobile technologies and other standard IS implementations. Success factors and issues of mobile field service implementations were explained briefly [12].

Many failed IT projects show that the implementation process is a crucial factor for the success of the integration and use of a new technology. So far, there is only limited research on mobile technology implementations. The implementation process was using the method of the way of working, thinking, designing and controlling. Five successful mobile technology implementations were compared and analyzed in this specific literature [12]. Important aspects of the implementation strategy and the used technology are examined and discussed. The results indicate that the success of mobile field service implementations is influenced by the implementation strategy, project management, change management, and technological restrictions of the used mobile technology. The analysis identifies, the complexity of

technological components and their limitations as well as aspects influencing user acceptance as central challenges for mobile technology implementations.

Mobile application development is becoming more challenging with diverse platforms and their software development kits. As the author description “in order to reduce the cost of development and reach out to maximum users across several platforms, developers are migrating to cross platform application development tools” [15]. In article, they provided several decision criteria beyond the portability concerns for choosing suitable cross platform tool for application development. The desirable requirements in a cross platform framework were identified and general architecture for cross platform application development was discussed [15].

However, different “write once run anywhere” tools such as PhoneGap, Titanium, Sencha Touch were provided along with a classification and comparison among the tools. To examine the performance in terms of CPU, memory usage and power consumption, Android test applications were developed as a methodology.

And finally, using such tools, they found that PhoneGap consumes less memory, CPU and power since it does not include dedicated UI components. The methodology followed in this paper is experimental to evaluate the performance of such tools; they have developed Android apps with four such tools PhoneGap, Titanium, Rhomobile, JQuery Mobile and more. It is measured the CPU usage, memory usage and power consumption. During the test, they found that PhoneGap consumes less CPU, memory and power than other tools. But the app developed using PhoneGap does not have a very good UI. To create a better UI, additional tools are required. In that case, Sencha 2.0 stands out among others. Finally the paper summarizes the contributions and concludes with some future directions [15].

Decision criterion	Native approach	Mobile web approach	Cross platform approach
Quality of UX	Excellent	Very good	Not as good as native apps
Quality of apps	High	Medium	Medium to low
Potential users	Limited to a particular mobile platform	Maximum including smartphones, tablets and other feature phones	Large - as it reaches to users of different platforms
App development cost	High	Low	Medium to low
Security of app	Excellent	Depends on browser security	Not good
Supportability	Complex	Simple	Medium to complex
Ease of updating	Complex	Simple	Medium to complex
Time-to-market	High	Medium	Short
App extension	Yes	Yes	Yes

Table 2.2 Decision criteria [[15]

Since this paper is about finding out the success factors which are helpful for developing mobile application, we need to consider those decision criteria to identify better approaches.

It is important to compare cross-platform development approaches for mobile applications. While smart phones are rapidly gaining popularity, they do not yet on a standardized platform [16]. At least five operating systems are considered important. Such as, blackberry, windows, ISO, and roid and Symbian operating system. Developing mobile applications is thus challenging. Since native development for several platforms requires extreme effort, they designed criteria to assess cross platform development approaches. It is a type of descriptive research which describes the framework criteria for evaluation. They applied criteria to Web apps, to apps developed with Phone Gap and Titanium Mobile, and for comparison to natively developed apps. Particularly the two frameworks are interesting from a Web developer's perspective since they bridge the gap between Web development and mobile information systems.

Finally, they generalize their results. Their criteria have proven to be viable for follow-up evaluations. With regard to the approaches, they specifically found Phone Gap feasible if very close resemblance of a native look and feel can be neglected. Their work makes several contributions. Firstly, it gives a comprehensive overview of current approaches for cross-

platform app development. Secondly, it proposes a framework of criteria for evaluation. They are not only applicable in this paper but can be used for future assessments. Thirdly, they present a detailed analysis of the considered approaches. Fourthly, they discussed and generalized their findings in order to provide decision advice [16].

Though, they identified the following criteria such as, development environment, GUI design, easy of development, maintainability, scalability, opportunity for further development, speed and cost development are identified as the major factor for development of mobile applications [16].

Intel IT created a mobile application development framework with a set of specific capabilities, tools, and resources that together enable mobile applications to be successfully planned, developed, and delivered into production. This framework augments Intel's existing approach to IT projects and standards to fully support the development of mobile applications. The created framework in response to Intel's employees' expectations to use mobile devices, such as smart phones and tablets, to access web-based and native line-of-business applications in the corporate environment. And, like users everywhere, Intel employees want both mobility and usability.

Until recently, project teams have developed applications primarily for Windows based PCs. Now with mobile application development framework, Intel's development teams accomplish the following [7].

- Evaluate the suitability of mobile applications for mobile use cases
- Follow governance standards
- Identify the correct project deliverables for mobile deployment

The framework includes a decision matrix that explores questions relating to application content, existing user base, use cases, and costs[7]. The matrix helps application development teams establish the business value of mobile development. After completing the framework, Intel IT deployed a number of mobile enterprise applications, including customer relationship management, social media, travel tools, and a paystub application. They developed and deployed several more applications, such as online collaboration and document sharing, factory worker applications, facility services, and expense reporting. They estimated extending the mobile application development framework to include new devices and new capabilities, supporting Intel's vision of a compute variety model of seamless. Developing mobile applications represents

major changes in both technical skill sets and in the approach to balancing functionality and usability [7].

Application developers should be aware of the differences between mobile OSs, able to perform cross-platform development with ease, and adept at developing for varying screen resolutions and taking advantage of device-specific features such as device sensors and touch screens, while adhering to mobile standards. Other areas of consideration during application development include [7]:

- Understanding that designing for simplicity and usability are key factors.
- Choosing an appropriate application deployment method, such as platform-independent HTML5 or platform-dependent native coding.
- Understanding mobile security issues, including portals, gateways and VPNs

To sum up having mobile application development benefited to the enterprise with regarding to raises awareness of the importance of targeting mobile devices, provides guidance and resources for application development teams to help them create effective mobile applications, and connects developers with a community of experts. By using the framework, teams can use best-known methods to develop mobile applications.

Playing mobile games was one of mobile entertainment application and it is expected to become highly popular and portable [17]. As it discussed above, the importance of mobile application development can be categorized as, communication: video, calling, mobile education, SMS, MMS; Information: for advertising product, scheduling; Transactions: mobile banking, finance, peer to peer payment; Entertainment: ringtones, mobile games, video, adult entertainment, music.

This specific work focuses on a mobile entertainment application which is called Mobile Gaming applications and it identifies critical success factors for adoption of mobile gaming. They identify the factors as follows [17]; In case of business: Compatibility, facilitating conditions (payment option) and trial ability.

In case of infrastructure: Accessibility, saving time, funny, usefulness, simplicity, interactive and innovation, culture, age, attribute to new technology, cost, technical and economic environment, privacy and security risk efficiency, complexity, relative advantages, communicability, entertain

images, and social acceptance. Those factors directly affect mobile application development in one or another way, specifically mobile gaming application.

Therefore, Some of the factors, ‘not all’, mentioned by different authors were checked whether it is applicable in our country or not using different method of data collection. Because it is difficult to cross check all factors mentioned by different authors due to some specifications mean that authors were selecting different factors by standing on different issues as a baseline. In our context our base line is organizational issues, technological issues and employee behavioral issues. The critical success factors were identified and categorized in groups for better practice.

Author and year	Objective /purpose	Methodology/approach	Major findings	Recommendation
Andreas, Sina and RothlaufOktob er,2006	-To analyses critical success factors of mobile field service applications	Case based methodology	Success factors are: 1. Implementation strategy, 2. Project management 3. change management 4. Technological restrictions of the used mobile technology	This literature can be used as an input to find out critical success factors in mobile application development
Thompson, july, 2009	-To identify success factors for mobile application development	Experimental research	Success factors are: 1. Entertainment factors 2. Usability factors 3. Maintenance factors 4. Utility factors 5. Functionality factors	Based on the identified factors discussed in this literature, we can categorize them for appropriate management
krassle petrova andhaxia,2006	- To Identify the critical success factors for mobile gaming application	Literature reviews and observation	The success factors are: 1.Accessibility 2.saving time 3.Age, cost 4.Simplicity & Usefulness, 5.Social acceptance, culture 6. Funny images 7.Privacy & security risk 8.Communicability 9.Efficiency 10.Complexity	Since mobile gaming is one part of mobile apps, this related work can be used as an input for identifying factors for all mobile applications also.
Isabelle and etal, ,2004	-To Choose suitable cross platform tool for application development	Android test apps developed as a methodology	Important decision Criteria 1. quality of UX and app, 2. potential user, 3. app devp cost, 4. security of app, 5. supportability 6. Easy upgrading, 7. time-to-market, 8. app extension	The decision criteria described can be used as an input to identify the success factor.

<p>Henning, Sebastian and Mim, 2012</p>	<p>-To design criteria to assess cross-platform development approaches</p>	<p>Case based methodology</p>	<p>They identify the 7 decision criteria namely:</p> <ol style="list-style-type: none"> 1. development cost 2. Development envt, 3. GUI design, 2. easy of development, 3. maintainability, 4. scalability, 5. opportunity 	<p>.It gives a brief understanding about approaches by designing criteria</p>
<p>Joseph, Aldeen, John & Soanes, 2012</p>	<p>-To increase awareness in developer side.</p> <p>-To Provide guidance and resources for application development teams</p> <p>-To help developers to create effective mobile apps</p>	<p>Experimental research</p>	<p>Major Issues during apps developments include:</p> <ol style="list-style-type: none"> 1. Evaluate the suitability of mobile applications, Follow governance standards 2. Identify the correct project deliverables for mobile deployment 3. Understanding that designing for simplicity and usability 4. Choosing an appropriate application deployment method, 5. Understanding mobile security issue 	<p>.Developers must be aware of the difference mobile Oss</p> <p>. By using framework, teams can use best-known methods to develop mobile applications. These have a direct linkage with mobile application development success factors.</p>

Table 2.3 Related work summary

2.6. CHALLENGES IN MOBILE APPLICATION DEVELOPMENT

One of the big challenges of mobile application is its platform capability and limitation [5]. There are platform problems and limitation can be observed and the main challenges of mobile application development are divided into three with respect to Architecture, data and content management, and user interface [5].

- **Architecture**

Mobile devices are challenging environments for software development because they have limited capabilities and programming interfaces and they are highly heterogeneous. Customization of mobile applications for individual device type is time consuming and costly.

- **Data and Context Management**

Data and context management can be described in two dimensions; hence, the main question that needs answered with respect to data management in mobile applications is what data to store on the mobile device, how to get it and how to keep it synchronized with data on a central server [5]. The underlying assumption here is that mobile users will not constantly be connected to a central server but will need access to data. Data will thus need to be transferred to the mobile device and managed locally before being re-integrated with the original data source. Often, these decisions are dependent on the context of the user [5].

- **User interface**

The developer needs to make sure that the interaction is adapted to the current situation of the user In addition to the above mentioned challenges [3]. One of the big challenges of mobile application is its platform capability and limitation. Beside the interesting usability of mobile application they have some more interesting platform problems and limitation. The limitations are discussed as follows:

- **Small Screen Size:** In mobile platform it is difficult or impossible to view text and graphics like a desktop computer screen.
- **Lack of windows:** In desktop we can see many windows at a time. But in mobile platform it is difficult.

- **Navigation:** Most mobile devices do not have mouse like pointer, so it has limited flexibility in navigation.
- **Types of pages accessible:** The mobile platform does not support all type of file format.
- **Speed:** The speed of processing and speed of connectivity of mobile platform is slow. Furthermore, here are the following limitations of mobile computing device [13]:

- **Insufficient bandwidth**

Mobile Internet access is generally slower than direct cable connections, using technologies such as GPRS and EDGE, and more recently HSDPA and HSUPA 3G networks. These networks are usually available within range of commercial cell phone towers. Higher speed wireless LANs are inexpensive but have very limited range.

- **Security standards**

When working mobile, one is dependent on public networks, requiring careful use of VPN. Security is a major concern while concerning the mobile computing standards on the fleet. One can easily attack the VPN through a huge number of networks interconnected through the line.

- **Power consumption**

When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices, this often means unusually expensive batteries must be used to obtain the necessary battery life.

- **Transmission interferences**

Weather, terrain, and the range from the nearest signal point can all interfere with signal reception. Reception in tunnels, some buildings, and rural areas is often poor.

- **Potential health hazards**

People who use mobile devices while driving are often distracted from driving and are thus assumed more likely to be involved in traffic accidents. Cell phones may interfere with sensitive medical devices. Mobile phone radiation and health have been raised.

- **Human interface with device:** Screens and keyboards tend to be small, which make them hard to use. Alternate input methods such as speech or handwriting recognition require training.

2.8. CONCEPTUAL FRAMEWORK OF MAD SUCCESS FACTORS

In this portion about mobile application development success factors conceptual framework were explained and “Conceptual framework is products of qualitative process of theorization that allows to guide the research” [28]. The framework is a Causal type of framework which discuss cause (independent variables) and effect (outcome).

The important factors discussed in different literature were checked whether or not associated with the success of mobile application development success. Those factors, ‘not all’, mentioned by different writers were checked whether it is applicable in our context or not using different method of data collection and statistical analysis. Because it is difficult to cross check all factors mentioned by different authors due to some specifications mean that authors were selecting different variables by standing on different issues as a baseline. In our context our base line is organizational, technological and employee behavioral issues.

The conceptual framework is developed by the researcher, the outcome (cause) and the effect were clearly directed using arrow. And the framework includes three category namely organizational, employee behavioral factors and technological factors. The related factors were listed under ether of the three categories having the same groups. This is to identify the associated factors to meet the objective of the study.

The categorization of success factors is formed by the researcher and it is consistent with the objective of the study. Also it is well organized and easy to understand. The conceptual framework ofMAD success factors were shown as follows in fig 4.4.

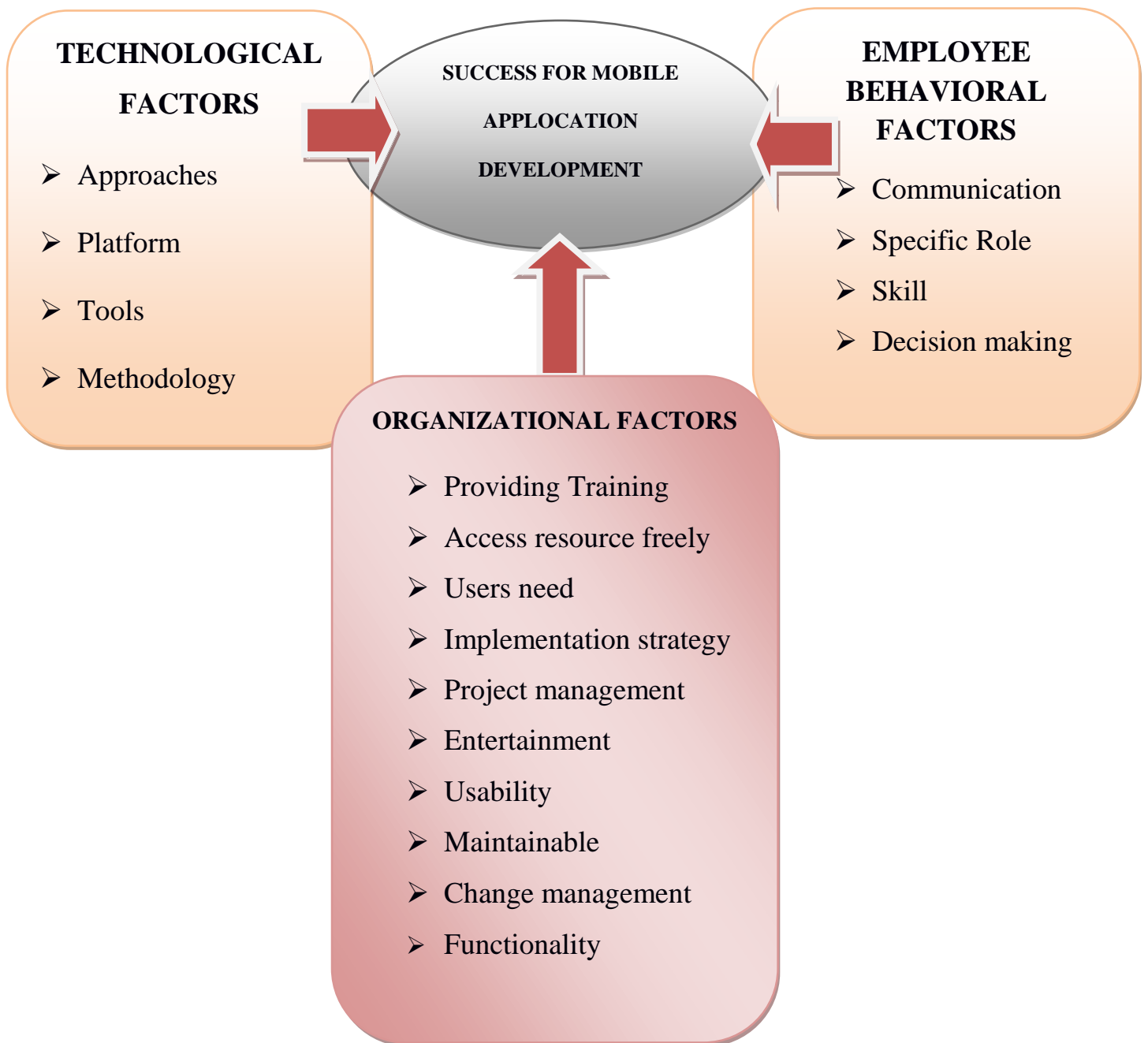


Fig 4.7 Conceptual Framework of MAD Success Factors

CHATER THREE

REASEARCH DESIGN AND METHODOLOGY

3.1. REVIEW OF RELATED LITERATURE

To attain an overall importance of the research, different related works are very important. So review of the literature used as a link between the proposed research and studies already done. It allows reader to know more about the aspects that has been already established by other authors and give a chance for the reader to appreciate the evidence that is already been collected by previous research and it will be easy to plan the current research work in the proper perspective [17]. Hence, for this research literature review is conducted and various books, journals, articles and internet is consulted to assess the critical success factors of Mobile Application Development.

3.2. RESEARCH DESIGN

Research design is the plan or strategy of shaping the research [18].A descriptive case study design and also both qualitative and quantitative research design were employed to gather information from study participants to identify and categorize critical success factors for mobile application development from selected mobile application companies in Ethiopia, Addis Ababa.

A descriptive research is a research design that describes and interprets ‘what is’, and it deals with individuals, groups, institutions, methods and materials in order to describe, compare and contrast, classify, analyze and interpret the events [19]. The research used descriptive research because it describes some aspects of phenomenon using research methods to achieve goal.

The research method used in this study was case study. As it described in article [19], case study emphasizes detailed contextual analysis of a limited number of events and their relationships. Case study is used due to largely descriptive examinations, and it uses of small number of sites.

About Qualitative research, it studies about experience, behaviors and attitudes from the respondent it include interview, participant observation, case study and content analysis [20]. And it allows to strengthening the quantitative result.

Quantitative research uses survey and questionnaires. Information dealing with numbers and anything that is measurable statistics, tables and graphs are used for the final result [21]. Hence, to achieve the aim of this research both qualitative and quantitative methods of research were used. In our context self-administrated questionnaire is employed to identify the different critical success factors of mobile application development for appropriate management and also face to face interview were held to provide detail and clear information about the mobile application development success.

Questionnaires (quantitatively) and in-depth interviews (qualitatively) were employed in this study for the collection of data from three mobile application development companies namely, Approbatics IT PLC, Apposite LLC and Techno Mobiles. After data gathering from data sources, data preparation analysis and discussion was perform. Then data analysis and discussion followed. Finally, based on the discussion and the analysis, conclusion and recommendation for future work is drawn.

3.3. STUDY POPULATION

The aim of this study is identifying Mobile Application Development critical success factors for appropriate management. To compare mobile application with software application, Mobile application development is a development that develops mobile application which applies on mobile device. But software could be used for desktop and personal computer including mobile devices also. Mostly, in our context, mobile application development companies are integrated with those software companies. Even if it is a new and on progressing development sector in Ethiopia there are some mobile application development companies existed. And if it used in manageable and organized way by identifying critical factors, lots of profit could be added.

All the necessary data for this study was collected from three selected mobile application development companies found in Ethiopia, specifically in the capital city, Addis Ababa. Namely: APPROBATICS, TECHNO and APPOISIT. The companies were selected by using purposive sampling by providing criteria. These criteria's are: more than five years' experience, large number of developers and well organized. The above companies satisfied the above criteria. The criteria are organized by the researcher in order to get sufficient information about the area.

3.3.1 SAMPLING METHOD

As the writer describe in article [23], a probability sampling methods is randomized selection in which all members of the population or target group have equal chance of being selected for inclusion in the study and it enables researchers to make reliable estimates of sampling error involving the statistical process.

A hybrid sampling of purposive and random sampling is employed in this study. Purposive sampling is used to identify and select three Mobile Application companies for the study based on three criteria. Such as, more than 5 years of experience, large number of developers and well known mobile application companies. And random sampling technique is used for the quantitative data collection process to give an equal chance of selection among the samples. From the study sample size 90% was given for quantitative data whereas 10 % was given for qualitative data due to small respondent size.

The researcher randomly picks the employees from employee attendance list using lottery method until the sample size fulfill. And then 57 respondents were nominated for the quantitative data collection process.

And the researcher select managers and project managers from each companies for in-depth interview by using purposive sampling, based on the criteria such as: those who have sufficient time to gave in-depth interview and available during the time of data collection. The company managers were nominated due to, it is assumed that they have more information about their company in detail than other employees.

3.3.2 SAMPLE SIZE DETERMINATION

For this study, the samples are mainly selected from three mobile application companies and the sample size is determined by using sample size formula. Sample size formula used to find the sample size for a research problem [19].

The sample is determined by three factors. These are: the level of confidence the researcher wants to test the results, the degree of accuracy the researcher requires to estimate the population

parameters and the estimated level of variation with respect to the main variable being studied [22]. In this study, for sample size calculation a sample error formula is used.

The actual sample size is determined using the formula of single population proportion formula for a single proportion population. And to determine the initial sample size the following assumption is used: assuming 5% margin of error (d), 95% confidence level (alpha, $\alpha = 0.05$, two tailed) so based on the above information the total sample size is calculated as follows

$$\triangleright n_i = \frac{(Z\alpha/2)^2 p(q)}{d^2}$$

Where

- ❖ n_i = required sample size
- ❖ Z = critical value for normal distribution at 95% confidence level which is equals to 1.96 (z value at $\alpha = 0.05$, two tailed) (test statistics to test if error committed or not)
- ❖ P = proportion (proportion of study done on Mobile application) (50%) = 0.5
- ❖ d = degree of freedom ,0.05 (5% margin of error)
- ❖ α = level of significance
- ❖ $q = 1 - p$

Assumptions: A 95% confidence level, margin of error (0.05).

$$(Z\alpha/2)^2 = 1.96 \text{ at } 95\% \text{ confidence interval (read from test statistics table)}$$

$$n_i = \frac{(Z\alpha/2)^2 p(q)}{d^2} = \frac{(1.96)^2 (.05)(1-0.5)}{(0.05)^2} = 384$$

Since sampling will be from a finite population ($N = 67$ which is less than 10,000, it needs the finite population correction.

$$n_f = \frac{n_o}{1 + n_o / N} = \frac{384}{1 + 384/67} = \frac{384}{1 + 5.5}$$

Where

$$n_o = 384, n_f = 57 \text{ and } N = 67$$

By considering 10% non-response rate, the total final sample will be $57+5.7= 62.7$

The total sample size is **63**.

3.4. DATA COLLETION METHODS

The main sources of data in this study are both primary and secondary data. As the writer describe about Primary data in [20], it isthe first-hand information collected by the researcher from the original source andin our context, it collected from direct interview and questionnaire, whereas the secondary data is obtained from different literatures, valuable books from internet, statics, figures as well as published materials.

3.4.1. PRIMARY DATA

3.4.1.1. Questionnaires

Questionnaire is a written list of questions the answer to which is recorded by respondents [20]. The primary data is collected using questionnaire from mobile application companies' employees. Distributing questionnaires' helps to have a primary data directly from the source andrespondent can express their feedback accordingly.

Semi-structured questionnaire is designed for the data collection. The questions are prepaid by the researcher by considering the objective of the study. So then, the questionnaire aims to meet the objective of the study.

The question has two parts: part 1 contains the back ground of the respondents, gender, age, education levels, positions, experience and departments. Part 2 contains questions requiring the respondents to state their agreement or disagreement on the issues of Mobile Application Development successes. In this study, the five point Likert-Scale (1=stronglyDisagree, 2= Disagree, 3=Moderate, 4= Agree, 5=Strongly Agree) from negative to positive dimension is applied due to universally accepted and more it is acceptable because of simplicity [24].

A Likert-scale is a composition of serious of four or more Likert-type items that are combined into a single composite score or variable during data analysis process and the item are used to provide a quantitative measure of character or personality attribute [25].

3.4.1.2. Interview

The respondent may not return the questioners at a time. For this reason, to reduce the failure rate, to be sure and to ask related question based on the respondent response, interview is more important, and can get more information about the topic [20]. There for the researcher employed in-depth face to face interview and also electronic mail is used to gather data and to get brief knowledge from the company managers and project managers of MAD. The company managers were nominated due to, the researcher assumed that they have more information about their company than other employees.

3.4.2. SECONDARY DATA

Secondary data is a data or information that is already available that described above. It can be obtained from different literatures, valuable books from internet, statics, figures as well as published materials. However, the researcher used those materials as a secondary data sources.

3.5. INSTRUMENTATION

As instrumentation, the researcher prepares important questions for both semi-structured questionnaire and in-depth face to face interview questions. The questions were developing based on the objective of the study and those questions aims to meet the study objective. Those questions were not adopting from others but the researcher by herself develops those questions.

3.6. STUDY VARIABLES

3.6.1. Dependent variables

- Success of mobile application development

3.6.2. Independent variables

1. Organizational factors:(Providing Training, Change management, Project management, User's needs, Implementation strategy, Usability, functionality, Maintainability and Companies Experienced)
2. Technological factors:(platform, tools, approaches and methods)
3. Employee behavioral factors (Communicate, Specific Role, Skill, and decision making)

3.7. DATA PROCESSING AND ANALYSIS

For the research, data is collected, presented, analyzed and interpreted by employing different techniques to attain the objectives of the study. The data analysis is done after collecting all the data from the respondents. After data collection, each questionnaire was checked visually for completeness and coded at the right margin of the questionnaire. The data were entered in to SPSS version 20.0 statistical software packages for data cleaning and analysis.

The statistical method which was used in the analysis is logistic regression at 95% confidence interval, P-value (<0.05) others statistical tools such as percentage, frequency and mean were employed to examine the relationship and statistical association between independent and outcome variables. Results were presented using statistical tools such as, texts, tabulation and percentage using SPSS version 20 statistics software. Also the data collected from interviews presented qualitatively using Daily Interpretive Analysis, DIA technique [26].

3.6.1. Collecting and Analyzing Interview Data Using DIA

A. **Collecting Interview Data:** Before analysis process the data should be collected. In DIA, Daily Interpretive Analysis, the data can be collected using either by using tape recordings and note taking or simply taking notes. In our case taking note is used for collecting interview data. ‘‘Taking adequate notes is both a skill and an art’’ [26].

The ability to write at a fast speed is necessary during interview, but it is also critical to be able to hear what is being said, and records the information in a manner that is both legible and faithful to the respondent. The notes that are taken are the basis of all subsequent analysis. Hence, it needs to develop standardized ways to treat the respondents. The following is a check list of items that we should consider, and develop during the interview:

1. Develop a standard form to record all notes: It should provide basic identification information (date, time, name of the interview, location, characteristics of the respondent, etc).

1. Date _____
2. Time _____
3. Location _____
4. Interview Id # _____
5. Author _____

Table 3.1Content Form [26]

2. Develop a consistent way to archive and store notes.

B. Analyzing the Data Using DIA:

The objective of the DIA is to assemble and interpret the information that was collected. At the end of every day of interviewing, it is crucial to write a report that summarizes and interprets the information obtained [26].

Moreover, one of the functions of the DIA is to document flashes of insight, or preliminary conclusions, which are collected during recording the respondents. The notes are analyzed to show the dynamic interrelatedness of the various pieces of information that the respondent presents. The respondent's discussion is therefore much more than a collection of reality reports, which simply require the interviewer to list. While concrete informational items are critically important, so it is the ways in which the respondent assembles aspects of his/her reality [26].

The insights or conclusions on any given day necessarily have a provisional status. They are much like "working hypotheses" or "preliminary theories." Subsequent interviews and DIAs may lead you to alter, refine, or even reject some conclusions or understandings that it may have had earlier in the process. Similarly, you may use the DIA to record an idea that is initially expressed as a vague notion, or a hunch, and later turns out to be one of major insights of the entire project. The only way to document and to keep track of these ideas is through the DIA [26].

C. Format of the Daily Interpretive Analysis:

The format consists of at least three parts: (1) Record, (2) Analysis, and (3) Conclusions, and Written notes taken during the interview of what was said will provide the raw materials for the report. The report must be sufficiently complete and written with sufficient clarity [26].

1. **Record:** The first section is a written interpretation of the information that was provided by the informant in the process of the interactive interview. The objective is to construct as complete a record as possible of what the informant said. In this case note taking is used for data record.

2. **Analysis:** Using the Record as a reference point, the second part of the DIA provides an analysis of the information by interpreting the information provided by the informant and relating it to the main objectives of the study. In contrast to the Record, the Analysis section requires the active involvement of the analyst who is expected to reorganize the information, and interpret the interviews in meaningful ways. This may entail drawing connections between different ideas or processes that were mentioned in the interview. [26].

The objective of the Analysis Section of the DIA is to interpret the content of the interview in a way that relates the findings to the objectives of the project.

The Analysis Section of the DIA is intended to be a creative exercise that draws on your background knowledge, your ability to listen with an open mind, and your capacity to link specific observations and particular pieces of information to more general concepts and relationships.

3. **Conclusions:** In this section it is encouraged to go beyond the Records and Analysis to draw more general conclusions. Statements in the Conclusions Section can be thought of as “working hypotheses” or “preliminary conclusions”. Therefore, the objective of the DIA is to assemble and interpret the information obtained from the data collected at the end of interview [26]. Three format of DIA is observed. One is recording data: which helps to constrict the information, the second is analyzing data using the recorded data as a reference point, which is DIA provide analysis information by interpreting the information provided by the informer and relating into the main objective of the study. Then finally conclude based on the result as a final format for DIA.

3.7. RELIABILITY AND VALIDITY

Reliability means the consistency of the measure that is important to detect bias [27]. In a simple random sampling such as timing of data collection, the unstructured interview using face to face and electronic mail used to strengthen the reliability of the information collected from respondents, the organization of questionnaire, data triangulation between quantitative and qualitative data make this research reliable because the researcher used the qualitative data to strengthen the result from quantitative result.

Validity means measuring what we want to measure [27]. Different statistical measurements such as logistic regression at 95% confidence interval and P value (<0.05), frequency, percentage and other statistical tools were used for this thesis to meet the objective of the study and to measure the variables. In our case, based on the instrumentation, the questionnaires were developed by the researcher and tested using pre-testing and necessary corrections and amendments were considered to check the validity of the questionnaire. And the interview questions were developed based on the study objective in order to strengthen the data collected quantitatively.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

To assess the existing Mobile Application success factors from three Mobile application Development companies' questionnaires are distributed for Application developers and Managers. The responses obtained through questionnaires are supplemented with interview. The analysis is done using SPSS statistics version 20. Frequencies, percentage, mean and standard deviation value is used for discussion for the questionnaire collected from those the companies. In general, the total number of questionnaires distributed was 57 and the returned questionnaires are 53 with a response rate of 92.9 %. Initially the questionnaire response rate was 80.7% to increase this response rate redistribution of questionnaire is undertaken which helps to improve the response rate by 12.2%.

4.1. DEMOGRAPHIC ANALYSIS

A total of 53 participants were enrolled in to the study in mobile application companies such as APPOSIT LLC, APPROBATICS INFORMATION PLC and TECNO MOBILES 1, of whom 47(88.7%) were males and 6(11.3%) were females. Majority (69.8%) of the study participants were aged between 20-30 years, (30.2%) were aged between 31-40 years (30.2%) with mean and S.D of 25±1.3). Concerning educational level of (69.8%) of respondents were bachelor degree holders and 30.2% of respondents were graduate degree (MSC). According to job category, majority of the respondents 44(83%) were software developer, 4(7.5%) project manager 3(5.7%) were team leader and the remaining respondents 2(3.8 %) were database administrator. Year of experience 30(56.5%) were 1-3 years and 11((20.8%) were 4-6 years. The demographic results were also presented graphically and by table as shown below.

Table 4.1. Socio-demographic characteristics of the respondents

Variables	Measure	Frequency	Percentage
Age	20-30	37	69.8%
	31-40	16	30.2%
Gender	Male	47	88.7%
	Female	6	11.3%

Level of educational	Bachelor degree	37	69.8
	Graduate degree (MSC)	16	30.2%
Job Category	Database administrator	2	3.8 %
	Project manager	4	7.5%
	Software developer	44	83 %
Year of Experience	Team leader	3	5.7 %
	1-3 years	30	56.5%
	4-6 years	11	20.8%
	7-9 years	8	15.1%
	>9 years	4	7.5%

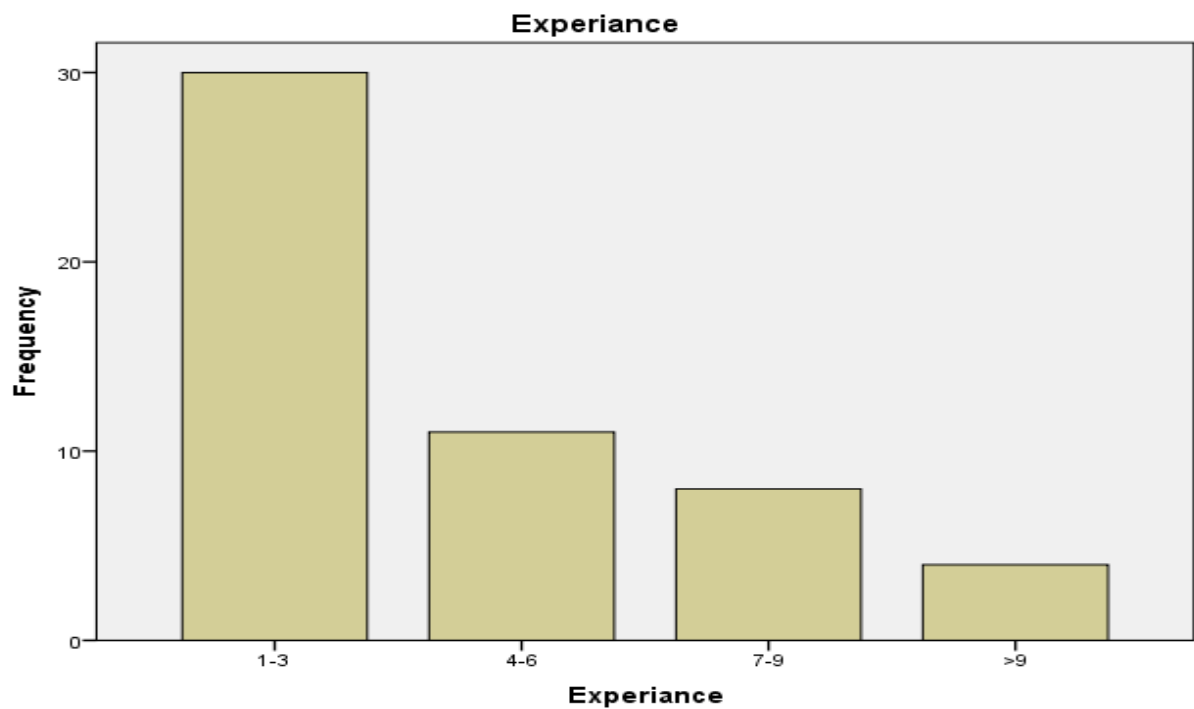


Fig 4.1 Respondents' year of experience in Mobile Application Companies

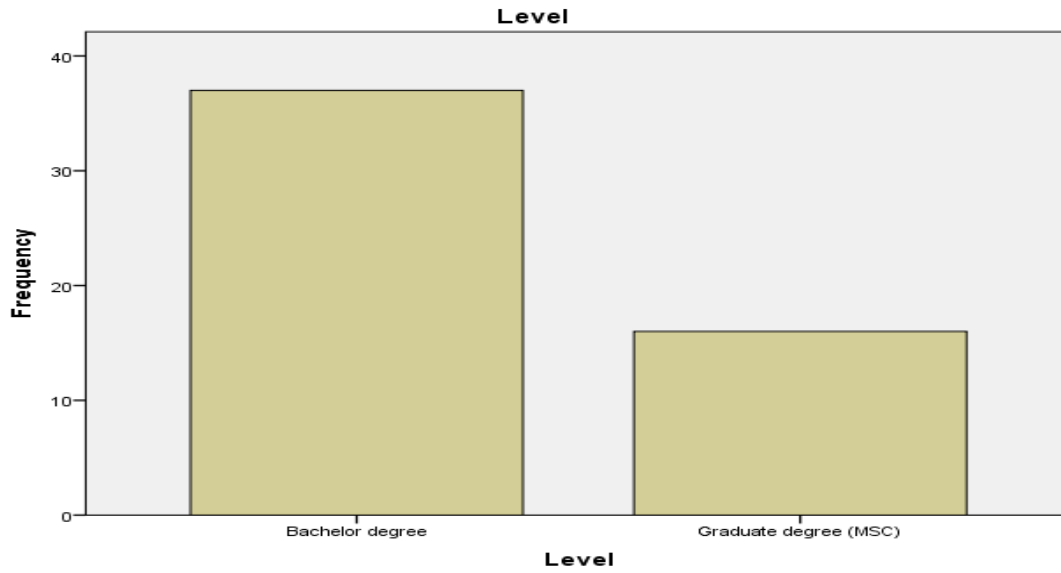


Fig 4.2 Respondent by their level of education

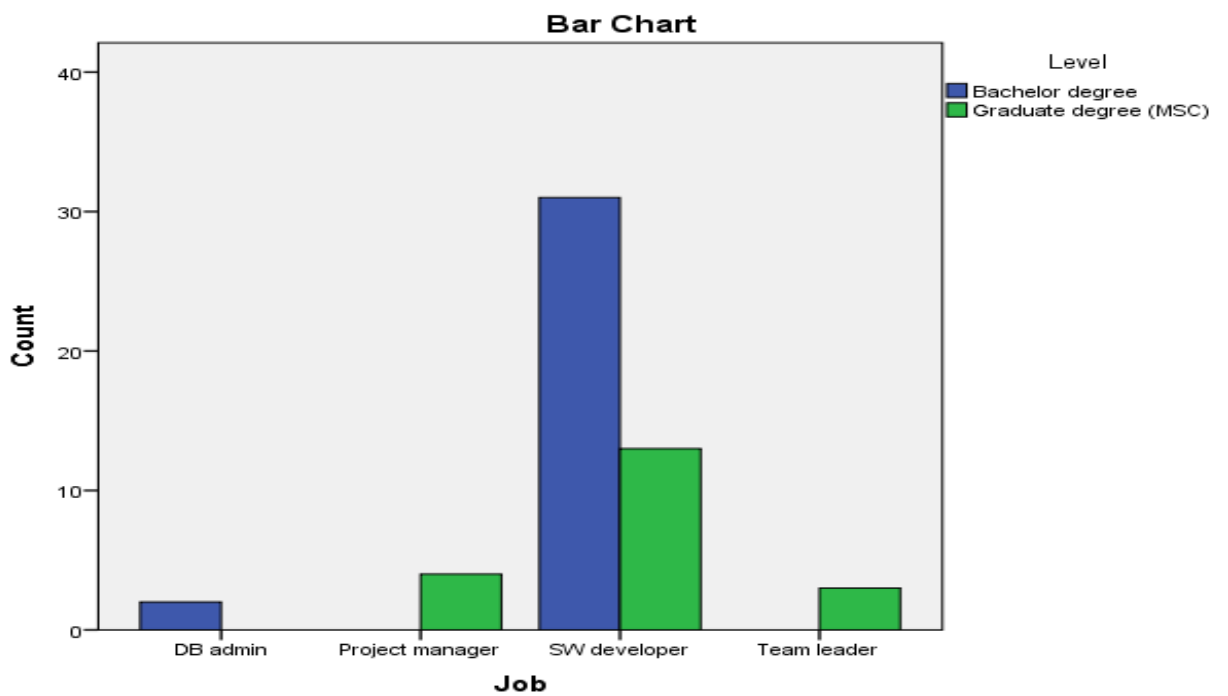


Fig 4.3 Job vis-a-vis level of Education

4.2. ORGANIZATIONAL FACTORS

One of the mechanisms to enhance the success of mobile application development is by providing training to the employee. In addition to these, the data presented in (Table 4.2) indicate that 56.6% (30) respondents were strongly agreed and 13(26.4 %) were agreed. In which training was found to be significantly associated with the development of mobile application in their company at P-value (0.01).

- *As one of the company manager said that most of mobile applications development companies in Ethiopia are not providing training for the developers instead the developers are using their personal skill by themselves, so it is better to provide training for the employee to increase their potential .*

In today's business sector, organizational factor helps for the success in mobile application development, to be profitable and competitive. Among organizational factors training, entertainment, maintainability and functionality were found to be significantly associated with mobile application development in a selected companies which was substantiated with the study finding by Sunni Thompson, 2009. Ensuring that the application meets more than one of the success factors will stack the chances of the application succeeding and this are entertainment factor, usability factor, utility factor, functionality factors and maintenance factors [11].

- *One of company staff disclosed that the company aims to add new features on Techno mobile phone and Techno products in order to attract end users and to keep the standard of the product and to be competent. Moreover, Factors which are conceder during mobile application development in our company are Users requirement, observation of current situation, application which are problem solver, developers' personal skill or creativity and in some case entertainment also.*

In case of company experience, 32(60.4%) of respondents were agree that the more experienced company could enhance for the success of companies in the success of mobile application development.

- *Companies experience is the cause for better mobile application development due to well organized, experience from previous equipped and gain knowledge by trial and error. In*

the same way, different companies are not yet knowledgeable about the use of MAD and also both organizations and government didn't give that much attention. For this reason, it's preferable to give attention for this business sector in order to gain high revenue, to solve problems and to make life easier.

Regarding to change management 29(54.7%) respondents were strongly agreed and 9(17%) were agreed. In which change management was found to be significantly associated with the development in line with these finding of mobile application in their company at P-value (0.032). Similarly, the success of mobile field service implementations was affected by the implementation strategy, project management, change management, and technological restrictions of the used mobile technology [12].

According to the data presented in (**Table 4.2**) indicate that 25(47.2%) respondents were strongly agreed and 23(43.4%) were agreed that maintainability was found to be significantly associated with the development of mobile application in their company at P-value (0.04). In accordance with these result, maintenance should be considered a long-term investment with a lifecycle almost as long as the average branded website. This means regular updates should be factored into a broad maintenance plan [11].

Regarding to functionality, 11(20.8%) were agreed and 37(69.8%) were strongly agreed that change management were significantly associated with the development of mobile application in their company at P-value (0.04). In line with these finding, similarly, mobile applications should not simply replicate a website instead mobile apps should take advantage of all the inherent features and functionality of the mobile device, such as GPS, camera, and motion sensor [11].

This study indicated that entertainment was not significant to mobile application development. These could be due to company focus on addressing the necessity rather than need of the customer.

➤ *One of company staff disclosed that “our company product regarding to mobile application are mostly used for billing and mobile phone features like SMS, IVR, and USSD telecom service purpose rather than for entertaining issues”.*

Table4.2. Organizational factors contribute to mobile application development.

Variables	Strongly Disagree	Disagree	Moderate	Agree	Strongly Agree	P-value
Training	-	3(3.8 %)	7(13.2%)	13(26.4 %)	30(56.6%)	0.01*
Accessibility to resources	-	2(3.8%)	2(3.8%)	22(41.5%)	27(50.9%)	0.424
Companies experienced	-	-	8(15.1%)	32(60.4%)	13(24.5%)	0.237
Users needs considered	-	-	2(17.9%)	22(56.4%)	10(25.6%)	0.57
Implementation strategy	-	-	5(9.4%)	28(52.8%)	20(37.7%)	0.23
Project management	-	-	7(13.2%)	29(54.7%)	17(32.1%)	0.43
Change management	-	-	15(28.3%)	29(54.7%)	9(17%)	0.032*
Entertainment	1(1.9%)	12(22.6%)	27(50.9%)	5(9.4%)	8(15.1%)	0.37
Efficiency	-	-	9(17.0%)	28(52.8%)	16(30.2%)	0.93
Maintainability	-	-	5(9.4%)	25(47.2%)	23(43.4%)	0.04*
Functionality	-	-	5(9.4%)	11(20.8%)	37(69.8%)	0.04*

4.3. EMPLOYEE BEHAVIORAL FACTORS

According to the data presented in (Table4.3) indicate that 25(47.2%) respondents were strongly agreed and 28(52.8%) were agreed that developers should be skilled, educated and trained for tools/ technologies used in the project. In which skill was found to be significantly associated with the development of mobile application in their company at P-value (0.01).

One of company manager disclosed that “We believe that mobile application develop process needs large amount of skilled manpower and those people should upgrade their knowledge time to time to come up with the changing technology so our employees are skilled and well educated, so for a better mobile application development in Addis Ababa, Ethiopia, developers should be skilled educated and experienced”.

In other case, this study indicated that communication, specific role and decision making was not significant to mobile application development with a P-value greater than 0.05. These could be due to lack of companies’ structure and one of the stuff managers disclosed the issue as follows:

“Mobile application is so much important and plays a significant role but in Ethiopia this is not seen in large due to shortage of budget, time and skilled human resource”

Table 4.3. Employee behavioral factors contribute to mobile application development.

N0	Question item	Strongly Disagree	Disagree	Moderate	Agree	Strongly Agree	P-value
1.	Communication	-	-	-	26(49.1%)	27(50.9%)	0.47
2.	Specified role	-	1(1.9%)	4(7.5%)	28(52.8%)	20(37.7%)	0.37
3.	Skill	-	-	-	28(52.8%)	25(47.2%)	0.01*
4.	Decision making	-	-	12(22.6%)	30(56.6%)	11(20.8%)	0.56

4.4. TECHNOLOGICAL FACTORS CONTRIBUTE MAD

According to the data presented in **(Table 4.4)**, approach in this result reveals 25(47.2%) of the respondent were strongly agree and (37.3%) were agreed that approach outlet for mobile application development at 95% CI = (0.01-3.201). In accordance with other finding, in evaluation of mobile application paradigms there are three approaches in mobile application development, namely the native approach, web approach and the hybrid approach that uses as a working environment to develop mobile application development [6].

Moreover, 24(45.3%) of the respondent strongly agreed and 10(18.9%) were agreed that platform such as Android Samsung, IOS apple, BlackBerry, Bada are options to develop mobile application at 95% CI = (0.07-8.47). In accordance with other finding, variety of different platforms emerged and developers are developing applications. An important issue for the application developer is to decide which platforms help to support mobile development. Currently, there are five important platforms are available such as: iPhone, Android, BlackBerry, Windows Phone and Symbian [4].

However, only 10(18.9%) of the respondents strongly agree and 23(43.4%) of the respondent were agreed that tools contributes to mobile application development at 95% CI = (0.19-36.52). In accordance with other finding, the accessibility of various kinds of tools allows SW developers to generate the task of the mobile application development from its early stage to its growing stage. There are many well-known tools of mobile application. Among those tools, these are well known, Cross-platform mobile development tools, such as Rhodes, PhoneGap, DragonRad and MoSync [9].

Regarding methodology, 14(26.4%) of the respondent were strongly agree and 26(49.1%) were agreed that methodology contribute for mobile application development success at 95% CI = (0.01-26.96). Which was comparable to the study conducted by Joseph Doolittle [7] showed that the critical success factors before developing Mobile application includes choosing an appropriate deployment methods such as, platform-independent html5 or platform-dependent native coding, understanding mobile security issues including portals, getaways, mobile virtual private networks and one-time password, determining the user base for each mobile OS, following established governance, path to production, and deployment models [7].

Table. 4.4. Technological factors contribute to mobile application development.

Question item	Strongly Disagree	Disagree	Moderate	Agree	Strongly Agree	95%CI
Approaches	-	-	8(15.1%)	20(37.3%)	25(47.2%)	0.01-3.201
Platforms	8(11.1%)	-	11(20.8%)	10(18.9%)	24(45.3%)	0.07-8.47
Methodology	2(3.8%)	-	11(20.8%)	26(49.1%)	14(26.4%)	0.01-26.96
Tools	-	-	20(37.7%)	23(43.4%)	10(18.9%)	0.19-36.52

4.4. DISCUSSION OF THE FINDING

This part of the thesis discusses the findings based on the result of the analysis. In our case, the critical success factors of mobile application development were identified. Based on the collected data the identified critical success factors categorized in three sections namely Organizational factors, Employees behavioral factors and Technological factors. The researcher selects those factors based on literature reviews and when we talk about mobile application those issues must be raised and basic in mobile application developing process. Also different failure factors were directed.

In this study, providing training with P-value(0.01), functionality with P-value(0.04) , change management with P-value (0.01) and maintainability with P-value(0.04) were mentioned as a critical success factors that strongly associated for the success of mobile application development because their P-value is less than 0.05 as consistent with the study finding by Sunni Thompson [11] and Andrias, Sina & rothlaufoktober [12] showed that the success of mobile field service implementations was affected by the implementation strategy, project management, change management, and technological restrictions of the used mobile technology. And the Author in [7] showed that the key factors for developing Mobile application were having understanding about designing for simplicity and usability.

In addition to this, technological factors includes: identifying better tools and techniques, methodology, platforms and approaches were selected as critical success factors in technological

perspective, Which was comparable to the study conducted by Joseph Doolittle [7] showed that the critical success factors before developing Mobile application includes choosing an appropriate deployment methods such as, platform-independent html5 or platform-dependent native coding, understanding mobile security issues including portals, getaways, mobile virtual private networks and one-time password, determining the user base for each mobile OS, following established governance, path to production, and deployment models [7].

And also the Authors showed in[6], in evaluation of mobile application paradigms, three approaches in mobile application development were importantly mentioned as, the native approaches, web application approaches and the hybrid approach. The important platform mobile development tools were listed by [9] such as, such as Rhodes, PhoneGap, DragonRad and MoSync [9]. Different platforms, Android, BlackBerry, and WindowsPhone were introduced.

In other case, Concerning behavioral issues, skill were one of the success factors with a significant P-value (0.01) and the rest factors such as communication, specific role and decision making was not significantly associated with the success of mobile application factors in employees as comparable to the study conducted by[7] it showed that Application developers should be aware of different technical issues like differences between mobile Operating systems. This issue link with the study in one or other way to direct that developers should be skilled and the other factors selected based on the researchers knowledge and the data collected from the interview and questionnaire.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

As we know Mobile application is widely used in the world especially in developed country. Not only this but also developing countries are applying Mobile application in day to day activities in order to solve problems, to entertain users, to gain revenue and so on. Most of the mobile applications are applicable in different Banks, like for example: mobile banking, mobile games, used for social networks, for different mobile devices and so on. Generally, we can say that mobile application development makes life easier and comfortable.

In this study, the researcher identified critical success factors of Mobile Application Development in selected companies such as Techno mobiles, Approbatics Information Technology PLC and Apposite LLC. Those companies are well organized than others, and they have large amount of developers and experts, and also has more than 5 years' experience.

This thesis is a descriptive research and the study design is case study. Both qualitative and quantitative techniques are employed in order to get full knowledge of Mobile Application Development success factors. And primary data is collected by using questionnaires and interview while different related literatures, articles and journals were used as secondary data.

The result of this study shows that the identified success factors of Mobile Application classified in three main categories based on literature reviews as it mentioned in fig 4.4. One is Organizational factors, Employees behavioral factors, Technological factors and finally different Failure factors were discussed. In Organizational factors: Providing Training, Change management, Project management, User's needs, Implementation strategy, Usability, functionality, Maintainability and Companies Experienced are mentioned as a success factors. In other case, Communicate, Specific Role, Skill, and decision making are in Employees behavioral factors. In case of technological factors: Tools and Techniques, Platform, Approaches and Methodology are recorded as a success factors for mobile application development. And finally, Lack of proper organizational structure, Lack of time and budget and Shortage of new Technologies are documented as failure cause.

Moreover, from the qualitative result the following description were obtained theoretically. The current mobile application development companies in Ethiopia are integrated with those SW companies. So the company may loss its organized structure. But in some case there are companies which are specifically develop mobile application. And their companies' products are mobile gaming, billing and different mobile phone features.

In other case, Company experience is the cause for better mobile application development due to well organized, experience from previous, equipped and gain knowledge through trial and error. And also factors which must be conceder during mobile application developments, in Ethiopians, are users' requirement (order), observation of current situation, problem solver application, by developers' skill and creativity and entertainment.

Most of the managers describe that all employees are degree holders and they didn't accept uneducated or unqualified employees due to the quality and benefit of the products. From this we can say that for a better MAD process in Ethiopia, developers should be skilled, educated and experienced.

Manager describe that they offer rewards for employees' who perform well in order to encourage the developers for better work. But, most of mobile applications developers are not providing training instead the developers are using their personal skill

Moreover, factors that cause for the failures of Mobile Application Development in Ethiopia are, the government restricted rules, knowledge gap among the companies, market problem and shortage of time , budget and skilled man power. Therefore, organization and government should give attention for Mobile Application Developments that many mobile application development companies could be structured and different problems will be solved. Due to this governmental revenue will increase.

5.2. RECOMMENDATION

To improve understanding about the new-coming technology which is Mobile Application Development in our country Ethiopia, the following recommendation is forwarded.

- Mobile application is a cause for economic and social change in the world that helps to solve problems, used as an entertainment. So the researcher recommends applying this business sector widely in order to gain more benefit, to solve problems, to entertain users and to gain more revenue for our country Ethiopia.
- In other case, the researcher observed that most of mobile application companies in Ethiopia are not well organized and structured instead it is integrated with those software companies because of very small population size in the area. But the researcher recommends mobile application companies to be well structured and organized and have its own specification.
- The researcher suggests that, since this thesis is new work and a descriptive research, it's more concerning with identifying critical success factors in mobile application development. So it better to add up with experimental results.
- Finally, this study is undertaken from three selected companies in Ethiopia. Therefore, further studies should be directed towards identifying critical success factors in mobile application development for better result.

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Appendix I

QUESTIONNAIRE

Currently, I am undertaking research Thesis on Taxonomy of critical success factors in Mobile Application Development at selected companies in Ethiopia, Addis Ababa.

This questionnaire is distributed for the employees of Mobile Application Company to identify Mobile Application Development critical success factors. The researcher would like to thank you for taking your valuable time in order to fill this questionnaire. Your response is confidential and is not given for any third party.

PART 1: Respondent Back Ground

No.	Questions	Response
1.1	Age	<input type="checkbox"/> 20-30 <input type="checkbox"/> 31-40 <input type="checkbox"/> 41-50 <input type="checkbox"/> 51-60 <input type="checkbox"/> >60
1.2	Gender	<input type="checkbox"/> Male <input type="checkbox"/> female
1.3	Level of Education	<input type="checkbox"/> Diploma <input type="checkbox"/> Bachelor degree <input type="checkbox"/> Graduate degree(MSC) <input type="checkbox"/> Doctorate (PhD)
1.4	Job category	<input type="checkbox"/> Database administrator <input type="checkbox"/> Project manager <input type="checkbox"/> Software developer <input type="checkbox"/> Team leader <input type="checkbox"/> System analyst <input type="checkbox"/> Network administrator <input type="checkbox"/> Maintenance <input type="checkbox"/> other (please specify)
1.5	Year of experience	<input type="checkbox"/> 1-3 <input type="checkbox"/> 4-6 <input type="checkbox"/> 7-9 <input type="checkbox"/> >9

PART TWO: Select or mark one from the five choices using the following manual.

1=Strongly Disagree [SD], 2=Disagree [D], 3=Neutral [N], 4= Agree [A], 5=Strongly Agree [SA]

No	Questions	SD	D	N	A	SA
Organizational Factors						
1.	Our Company providing enough Training for us in order to upgrade our knowledge.	1	2	3	4	5
2.	Our companies allow us to Access resources freely.	1	2	3	4	5
3.	Did experienced companies can develop better Mobile Application development?	1	2	3	4	5
4.	Our team members consider users need before developing Mobile application.	1	2	3	4	5
5.	Implementation strategy can affect mobile application development.	1	2	3	4	5
6.	I appreciate that strong Project management can be the reason for mobile application development success.	1	2	3	4	5
7.	Change management is functional in our organization for a newly coming technology.	1	2	3	4	5
8.	Our Organization focus on Entertainment factor before developing Mobile application.	1	2	3	4	5
9.	Usability factor is considered before developing mobile application in our organization.	1	2	3	4	5
10.	Mobile application should be Maintainable, so it is the important factor that must be in consideration during the development process.	1	2	3	4	5
11.	Functionality of Mobile application should be clear, simple for t users.	1	2	3	4	5
Employee behavioral Factors						
12.	Communication and share ideas with colleges for better effort in mobile application.	1	2	3	4	5
13.	Everybody has his/her own specified role to perform specific task in our team.	1	2	3	4	5
14.	Developers should be skilled, educated and trained for tools/ technologies used in the project.	1	2	3	4	5
15.	Expressing ideas and decision making with team member is important for mobile application. Technological factors	1	2	3	4	5
16.	Choosing best Approach is one factor during Mobile Application (like Native, Web and Hybrid)	1	2	3	4	5
17.	Better Platforms should be considered in the development process (such as, Blackberry, IOS, Android...)	1	2	3	4	5
18.	Follow Methodology and procedural step helps the development process	1	2	3	4	5
19.	Choosing better Tools and techniques can support the application development in easy way. (Like Phonegap, rodes, Bada tool, dragon)	1	2	3	4	5

Appendix II

INTERVIEW

1. What kinds of software development services does your organization provide? Is that mobile application only or other software development?
2. Do you think that companies experience affect the development process? If yes, How?
3. What are the critical success factors that influence Mobile Application Development process in your company? What things must be fulfilled for a better and profitable Mobile Application Development?
4. What kind of professionals should be involved in Mobile Application Development team?
5. As a manager of the company what thing must be done for the developer's in order to increase their performance?
6. What are the problems faced during the development process?
7. Do you think that mobile application is widely applied in our country, Ethiopia? If No, What do you suggest for better effort?

Declaration

I declare that the thesis is my original work and has not been presented in any other university.

AYDA GIRMAYE

FEBRUARY 2016

This thesis has been submitted for examination with my approval as a university advisor.

TIBEBE BESHAN (PHD)

FEBRUARY 2016