# A Mobile Application for Health Information Dissemination: a Namibian Context

Nikodemus Angula
Department of Informatics
Namibia University of science and Technology
Windhoek, Namibia
Email:chcangula@gmail.com

Nomusa Dlodlo
Department of Informatics
Namibia University of Science and Technology
Windhoek, Namibia
Email: ndlodlo@nust.na

*Abstract*— **Mobile devices have become the most powerful tool to disseminate information across communities in today's world. The current method of disseminating health-related information to the communities in Namibia is a manual system which is not efficient and effective. This study sought to identify an efficient and effective way to disseminate health information. The first phase of the study was qualitative, applying an interpretive approach and a qualitative multi-case study research design. Two hospitals, the Ministry of Health and Social Services (MoHSS), the Centre for Disease Control (CDC) and members of the community participated in this study. Face-to-face interviews, focus group interviews, questionnaires and document sampling were used as data collection methods to identify the requirements for a mobile application. Through laboratory experimentation, the second phase of the study led to the development of a prototype mobile application that will enable anyone to install the application on their phones in order to access general diseases information from the CDC.The first phase of the research concluded that a large number of Namibians own cellphones hence a mobile application would suffice. The most prevalent diseases from the research are malaria, diabetes, cancer and HIV, hence the initial application should concentrate on information dissemination for such. The mobile application content covers the common diseases in Namibia, their definition, the causes of the disease, the symptoms of the disease, how to prevent the disease and whom to contact.In the research conducted, the majority of the population is literate hence the application can support text-based information in addition to graphics. The research also found that a large number of people visit clinics and hospitals hence the mobile application will benefit both even those who visit clinics and hospitals as well provided they have smartphone.**

***Keywords—Mobile health, health information system, information dissemination***

## I. INTRODUCTION

Mobile applications are gaining momentum worldwide in providing healthcare services to communities. The increasing penetration of smartphones as well as 3G and 4G networks provides a significant boost to the use of the mobile applications for healthcare services provision to communities as a result of an improvement in healthcare information dissemination, amongst other uses. This benefits the communities since they do not have to travel long distance to access healthcare -related- information [2]. They can always use their mobile phones to access healthcare information. The health-care service providers also benefit due to the fact that transport costs are reduced when health information is disseminated to the regions, and as a result also health service provision costs [3].

The paper is structured as follows: Section 2 is the problem statement. Section 3 is the methodology, while section 4 is on related literature. Section 5 is on the findings of the research which feed into the development of the prototype. Section 6 is the architecture of the prototype and section 7 is the mobile application. Section 8 is the conclusion.

## II. PROBLEM STATEMENT

The current method of disseminating health-related information to communities in Namibia is a manual system which is not efficient and effective. Access to general diseases information is difficult, due to the sparsely distributed population of Namibia, which not only makes it difficult to provide health services, but also adds additional transport costs to those who want to access the general diseases information from hospitals and clinics. In addition, Namibia is divided into 14 autonomous regions, which in turn makes it difficult for the Centre for Disease Control (CDC) and the Ministry of Health and Social Services (MOHSS) to coordinate the dissemination of general diseases information to the communities. Extension workers from the CDC and MoHSS who are usually sent to different regions across the country to educate people about common local diseases that cause deaths only visit the regions quarterly.This study therefore sought to identify an efficient and effective way to disseminate health information.

## III. METHODOLOGY

Two hospitals in the Khomas region of Namibia, the MoHSS, the CDC and members of the Khomas community participated in this study. The first phase of the study was qualitative, applying an interpretive approach and a qualitative multi-case study research design. Face-to-face interviews, focus group interviews, questionnaires and document sampling were used as data collection methods to identify the requirements for a mobile application. Through laboratory experimentation, the second phase of the study led to the development of a prototype mobile application that would enable anyone to

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install the application on their phones in order to access general diseases information.

## IV. Related Work

The study conducted by (Yongjian, Shi, Li, & Wang, 2015) was to analyze the situation of knowledge dissemination in Chinese rural areasand explore factors that affect the efficiency of knowledge dissemination, to provide some suggestionsfor further improvements. The results show that factors of knowledge such as government participation,dissemination capability, learning motivation and trust have a positive effect on knowledge transfer.

The purpose of the study conducted by (Murthy, 2006) was to bring out the status of mobile device-based healthcare management systems in the world, particularly in India. The literature reported an SMS interface for receiving/sending SMS to 2G Mobile systemswhich receives the SMS, convert the SMS into a query and executes the query. The results are then sent as an SMS reply.

The study conducted by (Yang, 2012) stated that the use of mobile wireless data services continues to increase worldwide in the health sector. The author proposes using network-related characteristics to create a conceptual framework of these applications. Combining traffic symmetry and latency yields a 2_3 framework with six categories that characterize current and emerging 4G mobile applications, such as augmented reality, mobile social networking and m-health.

(Fitch & Adama, 2006), conducted a study that addresses some key management issues relating to developing mobile support for community healthcare (CHC) provision, such as support structures, service management and organization. A framework was developed relating to developing mobile support for community healthcare. The study acknowledges the use of mobile phones to provide service management to organization.

(Kaewkwungal, Singhasivanan, Khmsiriwatchara, Sawang, & Meanhkaew and Wechasrt, 2010) conducted a study that assessed the application of cell phone integration into the health care system to improve antenatal care (ANC). Information systems theory was used. A model combining web-based and mobile technology was developed to generate ANC/EPI visit schedule dates. The study was conducted in Kenya. The model improved ANC/EPI coverage in the study area along the country.

The study conducted by (Abdul Hafeez-Baig & Gururajn, 2009)was to understand the phenomenal of wireless handheldtechnology in healthcare environment. A framework was developed to understand the phenomenon in the technology healthcare environment. The study indicates that organizational readiness, technical readiness, clinical practice,social aspects as well as compatibility of new hardware with the existing system, play a crucial role in the adoption of wireless handheld devices in the Australian healthcare systems. The study acknowledges the use of wireless health handheld technology in healthcare environment.

## V. Features of the analysis that are integrated into the mobile application

The analysis of the questionnaires and interviews resulted in a number of findings. The research concluded that a large number of Namibians own cellphones hence a mobile application for health information dissemination will suffice. The most prevalent diseases from the research data collected are malaria, diabetes, cancer and HIV; hence the initial application will concentrate on information dissemination for such. From the research, the majority of the research sample population is literate hence the application can support text-based information in addition to graphics. The research also found that a large number of people visit clinics and hospitals hence the application will benefit even those who are not owners of smartphones but visit clinics and hospitals as well provided the clinics have access to mobile technologies. The developed application will be user friendly for usability purposes. In other words, the application will not be complex to use. The developers will ensure during the software deployment stage that the application is bug free for deployment. It will not be difficult for the users to install the application on their cellphones since it will be sent to their Gmail or Yahoo. The challenges that will be encountered will be rectified as they occur during deployment of the application, installation or launching. The benefits this application can offer are of significance in terms of making general disease information available to the communities timely. The information system (IS) and dissemination models for the mobile application are not available in the Namibian health sector hence the developers will make an effort to document the application developed so that end user will be at the position to follow through on how to use the application.

## VI. The architecture of the system

The database at the CDC stores information on diseases. A copy of the application that disseminates information is also stored on the same database. Users can register with the database for access to the application. They can download a copy of the application onto their cellphone by making a request to the server. Alternatively, where the users have smartphones the server sends the copy of the application to their Gmail and Yahoo accounts. Once the application resides on a user's cellphone, any server updates with disease information can be easily broadcast to the communities

The network architecture diagram (Figure 6.1) represents the general design guidelines for a mobile application, explains the key attributes, discusses the use of layers, provides guidelines for performance, security, and deployment, and lists the key patterns and technology considerations.

The user either uses a cellphone via USSD/ internet to access health related information from the file server from the CDC/MoHSS or the user can request information via USSD through a network antenna.

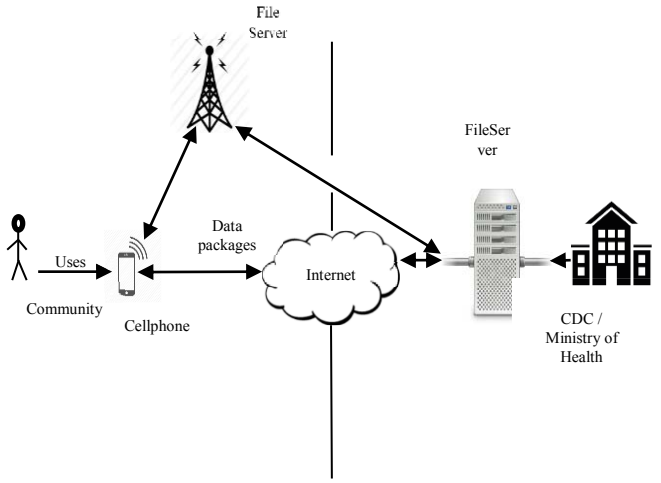


Fig. 1. Mobile Health information sharing Network Architecture Diagram

The key components of the architecture of the system are as follows:

- USSD- (Unstructured Supplementary Service Data) is a Global System for Mobile (GSM) communication technology that is used to send text between a mobile phone and an application program in the network. Applications may include prepaid roaming or mobile chatting.
- The Network Antenna is a specialized transducer that converts radio-frequency (RF) fields into alternating current (AC) or vice –versa. There are two basic types: the receiving antenna, which intercepts RF energy and delivers AC to electronic equipment, and the transmitting antenna, which is fed with AC from electronic equipment and generates an RF field.
- A data packages is a coherent collection of data and possibly other assets in a single package. It provides the basis for convenient delivery, installation and management of datasets.
- The file server is a computer responsible for the central storage and management of data files so that other computers on the same network can access the files in a client/server model. A file server allows users to share information over a network without having to physically transfer files by some other external storage device.
- A cellphone is a portable telephone that can make and receive calls over a radio frequency carrier while the user is moving within a telephone service area. The radio frequency link establishes a connection to the switching systems of a mobile phone operator, which provides access to the public switched telephone network (PSTN).
- The Internet is the global system of interconnected computer networks that use the internet protocol suite (TCP/IP) to link billions of devices world. It is a network of networks that consists of millions of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies.
- The CDC is an organization established in 2002 that manages the prevention, care, and treatment programs for various diseases.

## 4. THE MOBILE APPLICATION

The mobile healthcare application can allow members of the communities to access general disease information anytime and anywhere, without physically visiting the hospitals, clinics, CDC or MoHSS. The mobile application content covers the common diseases in Namibia, their definition, the causes of the disease**,** the symptoms of the disease, how to prevent the disease and whom to contact.

### *A. The development environment for the mobile application*

Android Studio was used to develop the mobile application. This is regarded as an integrated development environment that provides the fastest tools for building applications on every type of Android device. Therefore Android Studio is classified as the most world-class code editing, debugging, and performance tool. A flexible build system and an instant build/deploy system all allow one to focus on building unique and high quality applications. This implies that only mobile phones with an Android Operating System (OS) can use the application. The study opted to develop a mobile application that supports the Android Operating System because Android has the largest installed base of all operating systems of any kind. Another, is because Android has been the best-selling OS on tablets since 2013. On smartphones it is dominant by any metrics. The Android Operating system is developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices such as smartphones and tablets (statcounter.com, 2016). Android's user interface is mainly based on direct manipulation, using touch gestures that loosely correspond to real-world actions, such as swiping, tapping and pinching, to manipulate on-screen objects, along with a virtual keyboard for text input.

### *B.* The mobile healthcare application features and functionality

The mobile healthcare application consists of 11 modules or contents. The first content is the home. The home page has a number of buttons each representing a particular disease. For example, when you click on the malaria button you can find general information on what malaria is all about, what causes malaria to spread, what are the common symptoms of malaria, how malaria can be prevented and whom to be conducted should you are infected by malaria, etc. The other buttons are for diseases such as cholera, diabetes, tuberculosis, leprosy, coronary heart disease, cancer, HIV/AIDS and Ebola respectively.

Once the mobile application is installed on the smartphone that supports an Android Operating System, users will be able to click on the application menu and the information of various diseases will pop up. The application is in English text because from the research conducted, a large percentage of the population is literate.

### C. Use case scenario

A user requests to be added to the CDC server. The user downloads the application in order to access general diseases information anytime, anywhere without physically visiting CDC, clinics and hospital. The CDC compiles general diseases information and responds to the community requesting for the information. The CDC acts as the main actor in the storage of information and provision of information to the general public or communities.

The systems administrator uploads the information onto the system, and then sends notifications to the user. The system administrator can update general diseases information.

A use case diagram, at its simplest, is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case represents the functionality of the system. A UML diagram (see Figure 3) shows the use case for this mobile application. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well. The case use diagram above represents an actor (community) who can request health related information from the nurses or doctors at the main central point which is the CDC/Ministry of health. The nurses/doctors can respond to the queries of the member of the communities. In addition the nurses/doctors can update disease information. The community can also view various diseases information for example causes of diseases, overview of the diseases, prevention measures of the diseases and symptoms of the diseases

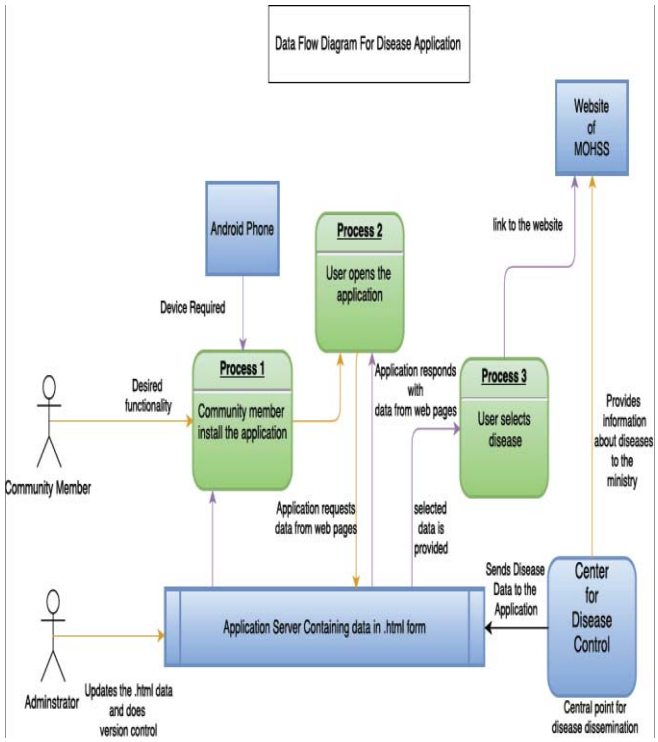


Fig. 2. The activity diagram that shows the sequence of events.

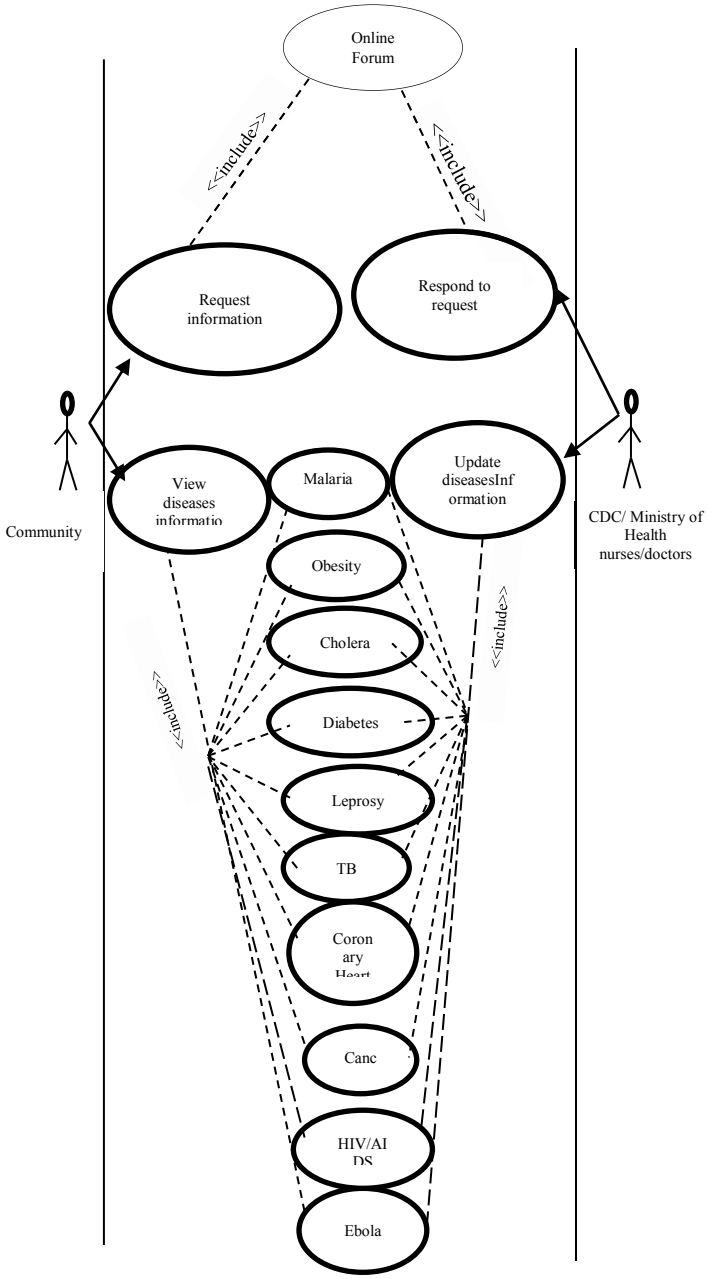


Fig. 2. Health information sharing USE CASE Diagram

### D. The activity diagram

An activity diagram is another important diagram in UML to describe dynamic aspects of the system. An activity diagram is basically a flow chart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. So the control flow is drawn from one operation to another. This flow can be sequential, branched or concurrent. Figure 2 is an activity diagram that describes the flow of processes in the mobile application. The activity diagram shows the processes involved of the mobile health application and the user. In the first process the community member with an Android phone will install the application. In the second process, the user opens the

application and in the third process, the user selects diseases and then the selected data will be provided from the application server. CDC sends diseases data to the application for the user to view them. The CDC can also provide information about diseases to the Ministry of health and Social services. The administrator is responsible to update general diseases information and does version control of the application.

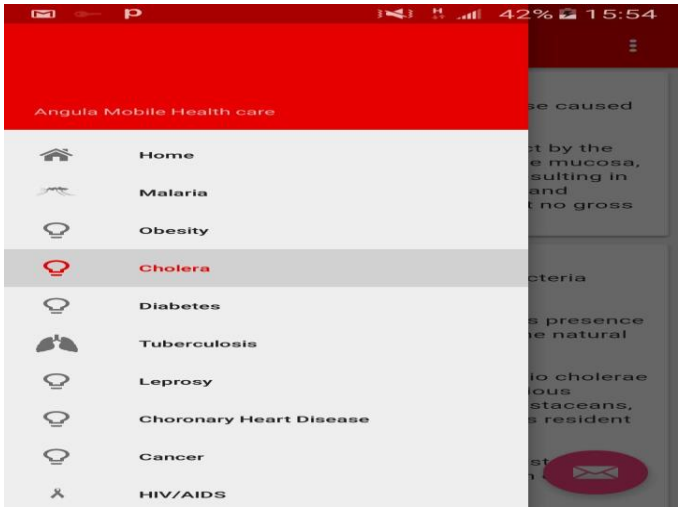

Fig. 4. Home page

### E. *The user interfaces*

Figure 4 shows the user interface that consists of the contents covered by the application which include 10 diseases such as malaria, obesity, cholera, diabetes, tuberculosis, leprosy, coronary heart disease, cancer and HIV/AIDS. The user can view disease images. The user can also post or ask health related questions and get feedback from a CDC system administrator.

## VII. OF THE MOBILE HEALTHCARE APPLICATION

The mobile healthcare application can operate effectively in rural and remote areas to provide health related information to an otherwise hard-to reach population. The benefits of the developed application are as follows to the communities:

- It will enable anyone to access general diseases information using mobile phones.
- It will enhance the accessibility of general diseases information to the communities in Namibia.
- It will eliminate the risks of lack of disease awareness information among the communities.
- It will enhance health in Namibia if implemented.
- It will supplement extension workers in the field.
- It will provide a common platform for everyone with a mobile phone to get general diseases information.
- It will add to existing knowledge in the fields of health and IT.

## VIII. EVALUATION OF THE PROTOTYPE

In research, the procedure of evaluation generally, is a systematic determination of a subject's merit, worth and significance, using criteria governed by a set of standards.

### A. *An expert review of the application*

The application was taken through the process of expert review and the comments were that any future development should consider aspects that are not included in the application. An expert review from the MOHSS suggested that the application should integrate help facilities such as contact details of ambulances, health centers/ hospital/ clinics, regional fire brigades, first aid centers and pharmacies. In addition, the same health expert suggested that the application should consider the type of users if there will be a possibility of them to use the application, for example, users can be semi-literate, illiterate and physically impaired people. Another expert from the Office of the Prime Minister suggested that the application integrates all the health centers, hospitals, clinics and also a possibility of the application to include features that would allow patients to visit clinics/hospital without a health passport card. An expert from the United Nations suggested the application should include features that would remind patients to take their medication after prescription from the hospital or clinic.

### B. *Usability*

The application is developed in a manner that it is user friendly which means user with an Android device will be able to download the application and install the application on their device. The user interface is easy to follow and not complex.

### C. *Efficiency*

The application isan effective tool for the CDC and this is attributed to the fact that it improves on the way the CDC disseminates information currently.

### D. *User satisfaction*

The users were satisfied with the prototype due to the fact that the application can be accessed via their mobile phones and majority of them use their smartphones every day. The users were satisfied with the application because they are literate which means they will use the app to read up on most diseases affecting them and also learn on how to prevent themselves from these diseases. In addition, users demonstrated that app will improve the current process used to disseminate general diseases information which is time consuming, costly and ineffective in the delivery of health information to the communities in Namibia.

### E. *Feedback time*

The application can be accessed anytime, anywhere without physically visiting CDC. The application can also be used as a platform to communicate directly with the CDC and receive feedback timely. The application, in terms of response time, is quite fast compared to the manual system in place at the moment.

### F. Speed

In terms of speed the developed app is faster than the manual system in place at the moment because a member of the community can request health related information anytime, anywhere, without physically visiting the clinics, hospitals and CDC.

### G. Adaptability

The application can adapt on the Android environment offline or online, which means member of the community will be able to view general disease information offline and on the other hand they can also post health related information online.
cts that were not covered in this research study.

## IX. Conclusion

The mobile application developed will contribute or improve on how CDC and MOHSS in the way they disseminate diseases general information to the communities in Namibia. Therefore people with smartphone will install the application in their smartphone and be able to get common general disease information Namibia that causes death to most the Namibian communities. In addition, if diseases general information is made available to the communities, this will enable the communities to be aware of knowing how to prevent themselves by this diseases, the causes of this various diseases, symptoms of this diseases, general background of this particular diseases as well as whom to contact should their get affected by this diseases.

## References


[1] Abdul Hafeez-Baig, R., & Gururajn, R. (2009). Exploratory study to understand the phenomenon of adoption of wireless hand-held devices in the Australian healthcare system. "Journal of Systems and Information Technology", *11*(1), 43-56.

[2] Boland, P. (2007). The emerging role of cell phone technology in ambulatory care. "Journal of Ambulatory Care Management", *30*(2), 126-133.

[3] Fitch, C., & Adama, C. (2006). Managing mobile provision for community healthcare support: "issues and challenges. Business Process Managment Journal", *12*(3), 299-310.

[4] Kaewkwungal, P., Singhasivanan, A., Khmsiriwatchara, S., Sawang, P., & Meanhkaew and Wechasrt, A. (2010). Application of smartphone in "Better Border Healthcare" programme: a module for mother and child care. Retrieved June 27, 2016, from http://www.ncbi.nlm.nih.gov/p

[5] Murthy, M. (2006). "Mobile-based primary healthcare system for ruiral India". Retrieved June 27, 2016, from https://www.w3.org/2008/02/MS4D_WS/papers/cdac-mobile-healthcare-paper.pdf.

[6] Phil, M. (2008). Mobile health potential tool for health care. Bellagio, Italy: Wiley and Sons Inc.

[7] Yang, S. (2012). Mobile applications and 4G wireless networks: a framework for analysis. "Campus-Wide Information Systems", *29*(5), 344-357.

[8] Yongjian, L., Shi, D., Li, X., & Wang, W. (2015). Influencing factors of knowledge dissemination in rural areas in China. "Nankai Business Review International", *6*(2), 128-155.

[9] Yun, Q. (2009). "Managing quality in the Chinese context: case studies of Shangai Manufacturing industries". *PhD thesis*. Retrieved June 27, 2016, from http://eprints.nottingham.ac.uk/14386/1/517794.pdf