**NIT6130 Introduction to Research**

Mobile Data Security: Methodology

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# Chapter 1

## Methodology

The purpose of this paper is to research, identify and select the most appropriate methodology for my research thesis whose topic is mobile data security. The previous assignment involved a review of the available literature on the subject. The review involved a broad scan of previous research on the topic and then a narrowed focus in which the researcher was able to identify and select the final two papers upon which the review was based. In this assignment however, the researcher will conduct an analysis of the various methodologies that can be used to approach the abovementioned research problem and provide solutions for the same. This particular assignment is covered in four main tasks as well as sub-tasks.

The first task is the statement of the research problem, divide the research problem into sub-problems where possible as well as align the collected literature (the two papers identified in previous section). The second task will be to identify the different types of research methodology by comparing and contrasting the different types of methodologies and identifying the most appropriate methodology for this particular research. The third task will be an analysis of the different types of research methodologies used in the collected literature and the selection of the one sub-problem for the furtherance of analysis of related literature. The analysis of literature will involve an intensive study of the research problems and the methodologies that were employed to provide solutions to those problems and finally, describe the relevance of the identified literature to the selected sub-problem. Lastly, the fourth task will be the proposition of the most appropriate methodology to be used for this research.

## 1.1 Research Problem and Reorganized Collected Literature

### 1.1.1 Research Problem Statement

Mobile data security may not be a new topic but with the rapid growth of the mobile data industry has also been accompanied by an unprecedented increase in data security threats. Recent trends in the mobile device industry and in particular the widespread use of smartphones and tablets has prompted a growing concern on the security of data usually held in and exchanged through these devices. The vast uptake and usage of smartphones and especially those that operate on the Android OS platform has raised concerns on the security and integrity of mobile data in the wake of an alarmingly high level of data vulnerability. The Android platform is the most popular operating system among mobile device users in the world. by the end of the year 2016, there were about 320 million devices operating on Android. The popularity is as a result of its open-source capabilities where software developers are able to develop applications compatible with Android OS and market them through the platform’s Google Play Store.

The increase in mobile device usage has enabled communication between people to become seamless, fast and convenient. In addition to seamless communication, access and control privileges have also changed over the years, to the current situation in which the user can easily manipulate data, control what to see and what not to as well as gain unlimited access to personal data. However, this access is not currently the way it was meant to be; cyber hackers have also developed ingenious ways of gaining access to a person’s sensitive information (what in other words and as will be used later on in this research, personal information (PI)).

Mobile data security is synonymous with mobile data vulnerability as discovered in the previous work of this research (a review of literature). Data vulnerability in mobile devices is as a result of increased usage accompanied by open-source software development. Previous works on this subject have established a positive correlation between mobile device usage and mobile data vulnerability. Increased usage of mobile devices has lead to a proportionate increase in data exchange over the various online and offline platforms. This research has identified mobile data security – vulnerability, as the problem that is most likely to be associated with the transaction of huge volumes of data as well as increased usage of smartphones.

### 1.1.2 Reorganized Collected Literature

 *Table 1.1*

|  |  |  |
| --- | --- | --- |
| **Research problem** | **Sub-problem**  | **Collected Literature** |
| Mobile data security | Mobile data control and access | * Walker, D., Sapp, K., Goldschlag, D. and Shahbazi, M., Trust Digital LLC, 2011
* Aljudaibi, Samaher. 2016.
 |
| Mobile data vulnerability |
| Mobile device usage | Mobile data storage | * Sujithra, M., Padmavathi, G. and Narayanan, S., 2015
 |

## 1.2 Types of Methodologies

The two major research methods are qualitative and quantitative research methodologies. A fairly new methodology was recently introduced in science and arts as a combination of the two main methods; this is the mixed (hybrid) research method. Research now has three options to choose from in terms of the needs and scope of the research problem and the objectives that the researcher wants to achieve. Scientific research predominantly uses quantitative methods to statistically approach different scientific problems. Therefore, a research that requires one to test the hypotheses can make use of the quantitative method to be able to establish a statistical relationship between the variables used. (Kowalczyk, 2016).

Qualitative methods use numbers and statistical figures to describe different phenomena under study. On the other hand, qualitative research methodology makes minimal use of numbers and figures as it uses the three Ws: why, when, and what, to describe the quality of the problem under study. Therefore, qualitative research paints a picture of the research problem in terms of what could be of the phenomenon under research. The two methods have been used for quite a long time in research but due to the fact that research in its absolute essence is evolving in nature, researchers have developed a generic version of the two methods, most like to call it the hybrid research method. Mixed research methods embody the best of both qualitative and quantitative research methods by eliminating biases that have previously limited the effectiveness of research evidence derived through the two methods. Therefore, mixed research method has an upper hand in research due to its unbiased nature (Creswell, 2003).

### 1.2.1 Qualitative Methodology

Qualitative research makes use of descriptions to derive meaning and understanding of the research problem. In this method, the researcher is usually a part of the research instruments. The methodology is intensely inductive and uses numerous assumptions to describe the phenomenon under study as compared to other research methods. Qualitative research methods are mostly used in research situations where there are no available variables to test and control, therefore making it a suitable research method on relatively new fields of study. The researcher’s effort to generate meaning and relevance of the research problem makes this type of research methods highly inductive and intuitive. Induction is best used when the research problem is not accompanied by sufficient data to scientifically test and control variables.

Researchers use this method when they want a generalized idea about a research problem by exploring, interpreting and describing the research problem. Intuition is used in this method to derive non-quantifiable data for instance, impressions, behaviours and feelings. Therefore, qualitative research method is characterized by the lack of rigid guidelines and minimal control as well as open-ended research procedures. The researcher has most control over their research problem while using this method.

### 1.2.2 Quantitative Methodology

This type of research methods is mostly associated with scientific research whose data and variables are readily available. The method is majorly based on scientific discovery and uses the traditional or conventional scientific methods to statistically gather, test, analyze and report findings. The very nature of this type of method is the fact that it is quantity-based and therefore predominantly uses numeric data to generate findings. Unlike the qualitative research method, this one is highly rigid and has strict guidelines and procedures on how the research should be conducted. In other words, it is highly structured.

Quantitative research methods are of two types: experimental and non-experimental quantitative research methods. As the names suggest, experimental methods involve the carrying out of experiments and thus carried out in the lab, where the researcher is able to control the variables (Padgett, 2016). A lab-based research is usually void of bias that is frequently associated with surveys and observation methods. Non-experimental methods are mainly survey-based and involve experimentation. Non-lab or non-experimental methods of quantitative methods use data that is collected out of the laboratory and as a result, surveys and observations are mostly employed in the carrying out of the research. A survey basically collects data and samples some of it from the entire population for study and analysis; for instance, data on market behaviour may be voluminous and as a result, a survey is done to come with a representative sample in which all the traits of the population are included and represented.

This method is most preferred in scientific research because through statistical analysis and lab experiments, the aspect of causation can be easily established and through causation, the researcher is able to identify the origin of the research problem and provide scientific solutions. Experiments enable the testing of a variable’s specific characteristics and behaviors as well as the contribution of a particular variable to the rest of the variables under study.

### 1.2.3 Hybrid Methodology

This is a mixture of both the qualitative and quantitative methods of research to derive findings and solutions regarding a particular research problem. This is a relatively new method developed by researchers with a view to eliminating the various forms of bias inherently generated through the use of either qualitative or quantitative methods of research (Creswell & Clark 2017, p. 25-32). In this method, both inductive (philosophical) assumptions and inquiry methods are employed. The direction that the research – right from data collection to data analysis is guided by philosophical design which employs various assumptions made about the research problem.

Fundamentally, hybrid research methodology is important because it combines both qualitative and quantitative research methods to derive a relatively vivid perspective of the research problem as one method would only create a fragment of the entire picture (Creswell & Clark 2017, p. 25-32). By painting a bigger picture of the research problem and doing so from the two extreme points of view i.e. the quantitative and qualitative points of view, mixed methods enhance the validity of the research by eliminating bias.

The hybrid or mixed methodology presents the similarities associated with the two sets of data especially in the instance where the two main methods exchange data. The method also employs different approached and strategies for instance, the sequential explanatory strategy which employs qualitative then quantitative data. The reverse sequence of data employment is used in the explorative strategy while both qualitative and quantitative data is used simultaneously in the transformative strategy.

### 1.2.4 Type of Chosen Methodology

From the discussion and analysis of the three types of research methodologies, this research has concluded that the hybrid methodology is the most suitable for the research problem this method has been selected due to its unbiased approach to research and the fact that it makes the best use of the two methods. Hybrid methodology will help with a flexible approach in which the researcher will consolidate the two methodologies used in the selected literature; the first paper uses a qualitative approach while the second paper is about a cryptographic approach which relied heavily on quantitative research methods to draw inferences on the safest and most cost-effective method of data storage on the cloud.

## 1.3 Review of Existing Methodologies

### 1.3.1 Selected Sub-problem

Upon conducting an intensive review of the research problem and coming up with the sub-problems, one aspect remained predominant in all of the literature gathered in regards to mobile data security – mobile data vulnerability. Data security and vulnerability have been suspected to have some sort of a correlation and it is for this reason that the researcher chose the sub-problem for further analysis.

### 1.3.2 Analysis of the selected Methodology

**Literature 1: Mobile data vulnerability: A Qualitative Approach into the relationship between mobile data security and vulnerability**

The first paper as was previously identified and selected, takes a descriptive analysis into the possible relationship between mobile data usage, security and vulnerability. The research was conducted entirely on the basis of qualitative analysis in which the researcher conducted an inductive review around the research problem by citing previous research. In the paper, the researcher identified the various mobile data security risks (vulnerabilities) and provided solutions to the same. Therefore, through descriptive research methods, the researcher was able to approach the research problem through a systematic discussion and analysis of the different types of mobile data vulnerabilities in terms of risks and threats.

The paper identifies eleven types or situations in which data security may be compromised and in this way, the mobile data becomes prone or vulnerable to security threats. First among the 11 situations – and one which will be the center of discussion in the next section – is mobile data storage.

**Literature 2: mobile data security: a Cryptographic Approach**

The second paper involves the use of a quantitative approach in which the researcher employed a technological (cryptographic) approach into the possible data storage techniques that can be employed to store data on the cloud. The paper creates a need for sophisticated data storage techniques citing that with the current level of mobile phone usage, safe data storage techniques are important to minimize vulnerability of data. Therefore, the researcher proposes cloud storage of a mobile phone user’s data to save on space and increase security by storing the data on the cloud, a platform on which attackers have limited capabilities.

According to Sujithra, Padmavathi & Narayanan 2015 p.483, the underlying research problem statement as used by the researcher is that the underlying amount of mobile data and cyber security threats calls for a highly-secure and a cost-effective technique of storing critical mobile data. Cryptographic approach is a technique that allows mobile device users to remotely backup and restore data from the device to the cloud storage and vice versa. The research conducts a quantitative survey into the various challenges facing mobile device users and identifies the aspect of unauthorized access as the main problem. As previously discussed the research paper proposes a hybrid approach to data storage which will enhance security for and easy access to stored data.

### 1.3.3 Relevance of the research problem

The two papers discussed above have a different approach to the main research problem – mobile data security. However, there is an interesting aspect of mobile data vulnerability in both papers; with the first paper identifying the various data vulnerability situations and the second paper identifies cloud storage of data as the best way to reduce mobile data vulnerability.

### 1.3.4 Summary of reviewed methodologies

 *Table 1.2*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Literature | Research problem | Methodology  | Sub-problem | Relevance  |
| Literature 1 | Mobile data security | qualitative | Mobile data vulnerability | Highly relevant |
| Literature 2 | Mobile data storage | quantitative | Mobile data vulnerability | Fairly relevant |

## 1.4 Proposed Methodology

This research hence proposes the use of a hybrid research methodology which will encompass the aspects of both qualitative (in terms of inductive discussions around the research problem) and quantitative (statistical variables and data to prove the discussions around the research topic). Section 1.4.1 is an explanation of why the researcher used the hybrid methodology while section 1.4.2 is the highlight of the benefits and limitations of the mixed research methodology.

### 1.4.1 Justification for the selected methodology

As discussed herein, mixed methodology cuts across both qualitative and quantitative research methods and in this way the researcher will be able to consolidate the proposed solutions in literature 1 and 2. In this method, the researcher will conduct an inductive analysis of mobile data security situations and related vulnerabilities while at the same time, collect data through the use of observation and questionnaires (if necessary), as will be guided by the discussion. Data on smartphone usage and mobile data security vulnerability is readily available, making the hybrid method the most suitable one for the research.

### 1.4.2 Benefits and constraints of the hybrid methodology

 **Benefits**

 - Non-biased results

 - makes use of the best in both qualitative and quantitative methods

 - enhances data integrity

 - Reliability of the research process and findings

 **Limitation**

 - Complexities in the approach

- Relatively new method and therefore lacks sufficient documented evidence of relative success

 - Method is expensive in light of the research’s budget

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