

UNIVERSITY OF EDUCATION, WINNEBA
COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

**EVALUATION OF BIOMETRIC REGISTRATION OF NHIS SUBSCRIBERS:
PROSPECTS AND CHALLENGES AT BANTAMA DISTRICT OFFICE OF NHIA**

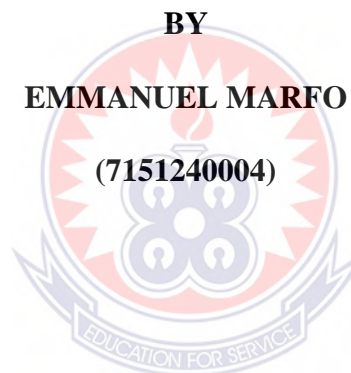


JULY, 2017

UNIVERSITY OF EDUCATION, WINNEBA
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DEPARTMENT OF ACCOUNTING

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**A Dissertation in the Department of ACCOUNTING EDUCATION Faculty of
BUSINESS EDUCATION, submitted to the School of Graduates Studies, University of
Education, Winneba in partial fulfillment of the requirements for the award of Master
of Business Administration (Finance) degree.**

JULY, 2017

DECLARATION

I declare that this thesis submitted to the graduate school of University Of Education Winneba Department of Accounting and that, except for references to other researcher work which have duly being acknowledged, this thesis has not been submitted to any other university for the award of a degree.

Signatures..... Date.....

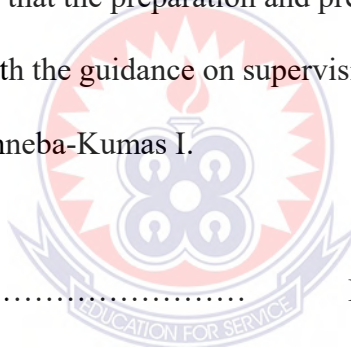
MARFO EMMANUEL

SUPERVISOR'S DECLARATION

I, Dr John Opoku hereby declare that the preparation and presentation of this project work was supervised in accordance with the guidance on supervision of project work laid down by the University of Education, Winneba-Kumas I.

Signature..... Date.....

DR. JOHN OPOKU



DEDICATION

This work is dedicated to my family, the AFRIYIE FAMILY whose encouragement has brought me this far. I also wish to dedicate it to my parent, MR. and MRS. AFRIYIE and wonderful friends, for their love and support during the pursuance of my academic work.

Special dedications to GOD ALMIGHTY for the Wisdom, Strength and Grace bestowed on me throughout these challenging periods.

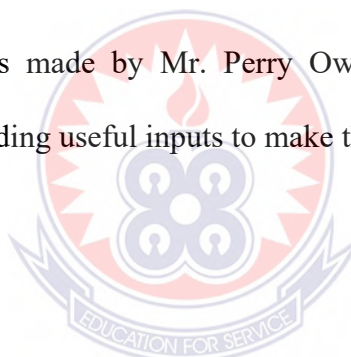


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ABSTRACT

In an increasingly fraudulent cases emanating from Ghanaian healthcare community, the initiation of an effective biometric system of registration can be a critical success factor. The study evaluates the biometric registration system at NHIA within the Ghanaian healthcare community. The study employed quantitative approach to evaluate the biometric registration system within the NHIA. The researcher adopted purposive sampling techniques in soliciting information for the study. SPSS statistical package and Microsoft Excel were employed in analyzing the data. The study established that, biometric registration process at NHIA is crippled with certain challenges that include frequent network failure, frequent shortage of consumables, high cost and long-queues created by clients. Again, the prospects of the system included positive identification of individual, inability for ones information to be falsified, the uniqueness of the user's template and also it fastness, reliability and effectiveness. The study finally recommend that prior to choosing an adequate biometric method, one needs to carefully research biometric performance measurements as they are important when we are balancing security and convenience. Biometric vulnerabilities must be defined so that they can be mitigated before clever attackers use them. Again security concerns need to be balanced with practica

l cost and operational considerations as well as political and economic interests.



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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

In perspective of Moore (2007) the word biometric emanated from the Greek language that implies measure of life. The system of biometric recognizes and authenticates the individual in light of their physiological and behavioural features. Fingerprints, hand or palm prints, iris, ear, nose, vein example of hand, face, DNA are viewed as the physiological features of biometric whiles key-strokes, mark, voice and stride are viewed as the behavioural elements of biometric. Jain, Ross and Pankenti (2006) contended that, physiological biometrics, for example, fingerprints and DNA are being widely used in forensic for criminal identification. This biometric has the likelihood of being utilized as a variety of civilian applications for Identification Management (IDM).

In an exceedingly secured and dependable confirmation of an individual, traditional IDM methods such as passports, ID cards, keys and passwords are not sufficient. Such IDM methods can easily be lost, stolen, speculated, forgotten or shared. However, the biometric technology based IDM systems are not easily speculated, stolen or tampered with since biometric traits are physically or behaviourally and naturally connected to an individual (Marcel, 2007).

Also, making duplicates of these traits require a comprehensive knowledge about technology and systems. Biometric based ID verification system offers more reliable mechanism for guaranteeing that only authorized or genuine users are able to access a system, enter in a facility or building, or cross international borders. Larger piece of biometric systems are installed as fixed systems, nevertheless the rise in the reliability in these systems additionally increases the demand for research to use them for portable applications. Motorola (2008) contended that the usage of mobile biometric identification devices (MBIDs) broadens the

functionality and capability of fixed biometric systems by allowing users capture the biometric sample like fingerprints and iris in the field and match them against a biometric database, either stored locally on the device or remotely in the centralized biometric matching system. The MBIDs offer an important front-line measure in IDM for government and commercial organizations. Nonetheless, these systems need to be more researched in size, cost, portability and applications.

Besides, UNICEF (2005) contended that many people living in poor countries lack any official documentation. In a sense, these individuals do not formally exist, and are therefore excluded from the many points of engagement between a modern state and its citizens. They cannot open bank accounts or register property. There is no easy way to confirm that they have received the public transfers or services to which they are entitled. Traditional social structures may provide local recognition, but communal systems of identification break down with internal migration and urbanization. For many poor people, this “identity gap” severely limits opportunities for economic, social and political development. Robust identification services are urgently needed to close this gap, but identity management systems have historically taken centuries to develop and mature in industrialized countries (Higgs, 2011).

Biometric identification technology is a potential solution. In one sense, the approach is hardly new. Individuals have identified each other by their appearances or their actions since the dawn of humanity. Fingerprints were embossed on seals centuries ago, and employed more systematically by law enforcement agencies beginning in the 19th century, when they displaced complex systems based on multiple body measurements. These approaches were useful in law enforcement, but had serious limitations. They were labour intensive, requiring expert analysts to spend hours measuring and comparing minute details. The precision of manual comparisons was hampered by human error and poor quality records. No expert could reliably recognize or verify a particular individual among a population of millions, let alone

billions, and the data was not robust enough to ensure that each individual was uniquely identifiable.

1.2 Problem statement

As indicated by Morosan (2010) while biometric system applications are extremely promising to its users, their large-scale deployment by organizations and adoption by the public is hindered by a number of challenges. Most importantly, the generally unknown nature of functionality of biometric to the public creates, and in some cases, amplifies these challenges. For instance Kim (2009) indicated that, one challenge encountered by the public in the application of biometric system is the fear of suffering physical harm as a result of using the system. As some biometric modalities require that users interact with or touch the reading sensor (fingerprinting), it is natural that some subscribers become concerned about the hygiene of the sensor.

Furthermore, Kim and Forsythe (2008) added that, users may feel generally anxious toward the use of information and communication technology, developing feelings of anxiety toward technology. Intuitively, biometric technology makes no exception. For some individuals, biometric anxiety may develop from information privacy concerns, while for others, it may develop based on certain beliefs, such as the belief that fingerprinting is used for criminals, or that using biometric systems may alter one's dignity. Consequently, an individual may display strong negative emotional responses to biometric systems based on the beliefs about dignity and the queue that the process creates in its application.

In view of the above case it is very imperative to carry a research to evaluate the biometric registration system adopted by NHIA in order to bring out the challenges and prospects of the biometric system. Additionally the research aids in bringing out solutions to the challenges encountered within the biometric system of registration.

1.3 Aim/Objectives of the Study

The general aim of the study is to evaluate the biometric system in the registration of NHIS subscribers with special focus on Bantama sub-metro office of the National Health Insurance Authority (NHIA) of Ghana. Specifically the study wishes to address the following objectives:

1. To examine the biometric registration system adopted by NHIA.
2. To examine the challenges encountered in the biometric registration system within NHIA.
3. To examine the prospects of the biometric registration system adopted by NHIA.
4. To establish the effectiveness of the biometric registration system adopted by the NHIA.

1.4 Research questions

The following questions will serve as a guide to the study.

1. What biometric system of registration does NHIA employ?
2. Does the biometric system of registration of NHIA exhibit some challenges in its performance?
3. What benefits does the biometric system of registration have to offer the clients of NHIA?

How effective is the biometric registration system adopted by the NHIA?

1.5 Scope of the Study

The study encompasses the evaluation of the biometric system of registration within the Ghanaian context. The research was conducted on National Health Insurance Authority's biometric system of registration with Bantama Sub-Metro office of the NHIA within the

Kumasi metropolis as the case study. The target population included the management, staff and subscribers of the NHIS of Bantama Sub-Metro office of the NHIA.

1.6 Justification of study

Generally, since Ghana is an emerging economy and the use of biometric system of registration in Ghana is still in the infant stage with insufficient facts about the application and the challenges associated with it a number of clients may still maintain a certain common level of anxiety towards biometric system, that may affect their attitudes towards such system and acceptance conduct. In view of the above scenario, there is a reason to evaluate the biometric registration system adopted by Ghanaian organizations with special focus on NHIA.

1.7 significance of study

Proper understanding and evaluation of biometric system of registration should lead towards improvement in the services of the NHIS. The complete knowledge and awareness of biometric system of registration should help to improve the performance of the institution and consequently reducing the queue of customers willing to access the facility. The study will enable management identify the drawbacks within the biometric registration system for proper review. Academically, there is no doubt that this study will add up to the existing body of literature on biometric system of identification on the African and for that matter the Ghanaian perspective and also serve as a guide to future research.

1.8 Organization of the study

The study is divided into six chapters. Chapter one contains the introduction of the topic which covers the background of the study, problem statement, research objectives and questions, justification of the study, significance of the study, scope of the study and

limitation of the study. Chapter two presents the literature review in the area of biometric system of registration. Chapter three contains the methodology of the study. The fourth chapter presents research findings and results. Chapter five presents the analysis and discussions of findings. Finally chapter six presents the summary of research findings and analysis, conclusion, recommendations and suggestions for future research.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literatures in terms of the evaluation of biometric registration system with respect to the challenges and prospects of such a system. The chapter discusses the concepts including biometric systems, prospects and challenges of biometric system, common traits in biometric and its implication on performance.

2.2 Concepts of Biometrics Systems

Boneh and Franklin (2001) argue that biometrics perceive natives by measuring some part of individual life structures or physiology including hand geometry or unique mark, profoundly instilled expertise, or other behavioural trademark, transcribed signature or something. Boulton & Scheirer & Woodworth (2007) argue that biometric check advancements, for example, face, finger, hand, iris, and speaker identification which are right now accessible and are as of now being used. Once more, biometric framework is fundamentally an example location framework that works by gaining biometric information from an individual, extricating a list of capabilities from the procured information, and contrasting this list of capabilities against the layout set in the database.

2.3 Biometric Registration Process

2.3.1 Enrollment Process

The enrollment process is fundamental one which applies to all systems that try to distinguish people utilizing biometric. These strides incorporate the starting catch of biometric data, the consequent processing or conditioning of these data for storage purposes, the extraction of specific components in the data, and the generation of a biometric template (Hollingsworth, 2008).

2.3.2 Verification process

The second process is the verification strategy, in which the framework approves a client's personality by contrasting the catch biometric information and the clients' own particular biometric template put away in the framework database. Inside of the verification framework a client who is to be perceived cases a character through Personal Identification Number (PIN) a client name and a shrewd card. The framework then performs a coordinated relationship to choose whether the case is genuine or not.

2.3.3 Identification process

In the identification mode, the framework perceives a person via seeking the formats of the considerable number of clients in the database for a match. Along these lines, the framework leads a one-to-numerous correlation to build up a singular's personality (or comes up short if the subject is not selected in the framework database) without the subject needing to assert a character. Identification is a discriminating segment in antagonistic acknowledgment applications where the framework sets up whether the individual is who she (certainly or unequivocally) denies to be. The reason for pessimistic acknowledgment is to keep a solitary individual from utilizing numerous characters. Identification might likewise be utilized as a part of positive acknowledgment for accommodation (the client is not needed to assert a character). While customary routines for individual acknowledgment, for example, passwords, PINs, keys, and tokens may work for positive acknowledgment, negative acknowledgment must be built up through biometrics (Boult Scheirer & Woodworth, 2007). Furthermore, behavioural biometric incorporates methods, for example, signature acknowledgment. Key stroke flow acknowledgment, walk acknowledgment and discourse or voice acknowledgment and have been alluded to in the writing as conduct measurements (Nisenson et al., 2003). Not at all like routine strategies that depend on what you know, (for example, passwords, individual identification numbers (PINs) or cryptographic keys) or what

you have (e.g., personality tokens or access cards), biometrics rely on upon aspects of the human body, particularly what you are and what you do and are along these lines accepted to be more grounded or better advances as they cannot be overlooked or lost. Inside of the writing it is for the most part concurred that a substantial estimation must fulfill certain prerequisites before it can qualify as a 'biometric': it must widespread particular generally changeless, and gather capable Universality' that all members in a given populace have the trademark.

2.4 Performance of Biometric Systems

According to of Hollingsworth (2008), biometric is the process of identifying an individual based on physiological or behavioural characteristics. Biometric can be used in at least two different types of applications. In a verification scenario, an individual claims a particular identity and the biometric system are used to verify or reject the claim. Verification is done by matching a biometric sample acquired at the time of the claim against the sample previously enrolled for the claimed identity. In an identification scenario, a biometric sample is attained without any associated identity claim. The mission is to identify the unknown sample as matching one of a set of previously enrolled known samples. The set of enrolled samples is often called a gallery, and the unknown sample is often called a probe. The probe is matched against all of the entries in the gallery, and the closest match, assuming it is close enough, is used to identify the unknown sample. Similar to the verification scenario, there are four possible outcomes (Hollingsworth, 2008).

Additionally, a true positive occurs when the system says that an unknown sample matches a particular person in the gallery and the match is correct. A false positive occurs when the system says that an unknown sample matches a particular person in the gallery and the match is not correct. A true negative occurs when the system says that the sample does not match any of the entries in the gallery, and the sample in fact does not. A false negative occurs when

the system says that the sample does not match any of the entries in the gallery, but the sample in fact does belong to someone in the gallery (Hollingsworth, 2008).

2.5 Biometric System of recognition

A biometric recognition system involves two basic phases: enrollment and recognition. In the enrollment phase, a sensor collects the biometric data from which a set of features are extracted (template) and stored in a database along with the individual's identity (name, ID number, etc.). In the recognition phase, the identity of an individual is either confirmed (verification) or determined (identification) by collecting the biometric data again, extracting the same features and comparing them to the features stored in the database. From this comparison, a match (similarity) score is generated and used to make a decision to whether the two sets of features came from the same subject or not (Jain Ross & Nadakumar, 2011).

A threshold on the match score is usually applied to decide whether the two biometric samples are true mates. If the match score is higher than the system threshold, then the samples are considered to be from the same source. Otherwise, they are considered to be an impostor pair. An example of the verification scenario occurs when you try to use the ATM at a bank and you have to provide biometrics data along with your ATM card to verify your identity. In this case, the owner of the ATM card is known, so the biometric system needs to ensure that the true owner is the one who is using the card to perform the transaction. In the identification mode, the user does not claim any identity. The user only provides his/her biometric data, and the data is compared to the stored template of every subject in the system database (Paulino, 2013).

2.6 Common Biometric Traits

Several biometric traits have been used for recognition, such as face, fingerprint, iris, palm print, hand geometry, voice, ear shape, signature, key stroke and gait. We focus on

fingerprint, face and iris, which are the most prominent traits. Each biometric trait has its strengths and weaknesses, and the choice of a biometric trait is usually dictated by the application requirements. It is generally known that fingerprints are very distinctive, and the overall ridge structure does not change significantly over time (from infants to old age); even after superficial cuts on the finger, the fingerprint pattern reappears after the healing process (Jain, Ross & Nadakumar, 2011). This is supported by the high matching performance of state-of-the-art system in rolled/slap fingerprint matching. Fingerprints are relatively easy to acquire, but require some degree of cooperation from the subjects. Also, some people might not have strong fingerprint pattern suitable for automatic recognition due to genetic factors, occupation, and aging (Jain et al 2011).

Face is one of the most convenient biometrics in terms of acquisition and it does not even require cooperation from the subject. Face images can be easily acquired, even from a distance and without the subject's knowledge. This advantage is especially useful in surveillance applications. However, many variations in face images such as pose, lighting, expression, and changes in appearance such as make-up and accessories, make face recognition a very challenging problem (Jain et al., 2011). This explains the low distinctiveness of state-of-the-art face recognition systems in unconstrained scenarios. Furthermore, face characteristics might not be stable over time (due to weight gain or aging). Iris image capture requires a more sophisticated and expensive sensor because the useful texture patterns are better captured in near-infrared images; it also requires the subject's cooperation (subject must stand at a specified distance from the iris camera) and the iris quality can be influenced by a number of factors such as partially closed eyelids, eyelashes, contact lenses, etc. However, studies on large scale databases suggest that iris recognition system can achieve extremely low error rates (Grother et al 2012).

2.7 Fingerprint Representation and Matching

A fingerprint is the impression of the friction ridge skin on a fingertip. Friction ridge skin presents raised ridges because their function is related to grasping and gripping; this explains their presence in the palms of our hands and sole of our feet. The characteristics of a fingerprint are determined during fetal development and its formation starts at approximately 6 or 7 weeks of gestational age (Li & Jain, 2009). The fingerprint pattern is mostly determined by the gestational environment, since minor changes in the flow of amniotic fluids are responsible for the differences in the skin structures around palm or finger tips. Thus, the fingerprints of every person are different among themselves, and different from fingerprints of other persons.

There are essentially three types of fingerprint images that are acquired for matching: (i) rolled, which is obtained by rolling the finger from “nail-to-nail” either on a paper (in this case ink is first applied to the finger surface) or the platen of a scanner; (ii) plain, which is obtained by placing the finger flat on a paper or the platen of a scanner without rolling; and (iii) latent, which is lifted from surfaces of objects that are inadvertently touched or handled by a person typically at crime scenes. Rolled and slap fingerprints are generally captured under controlled conditions and by cooperative subjects. On the other hand, latent prints are left by criminals at crime scenes. For this reason, rolled and plain prints (collectively referred to as reference prints) are of much better quality than latent. The two first types (rolled and plain) are usually collected in the form of a ten print card, which is a card that contains rolled and plain impressions of the ten fingers of a subject, along with their identity information (Paulino, 2013).

2.7.1 Representation

The structure present in a fingerprint is composed of ridges and valleys. In a rolled fingerprint image obtained by using ink, the ridges are the dark areas corresponding to the raised ridges in our fingers and valleys are the bright areas that correspond to the space between the raised ridges. Fingerprint characteristics or features can be categorized into three different levels (from coarse to fine): Level 1 (ridge flow), Level 2 (minutiae) and Level 3 (pores, incipient ridges, dots, etc.) (Maltoni et al., 2009). Figures 1, and solved show examples of the lever of finger points and examples of features in the three levels.



Figure 1: examples of the three levels of finger points

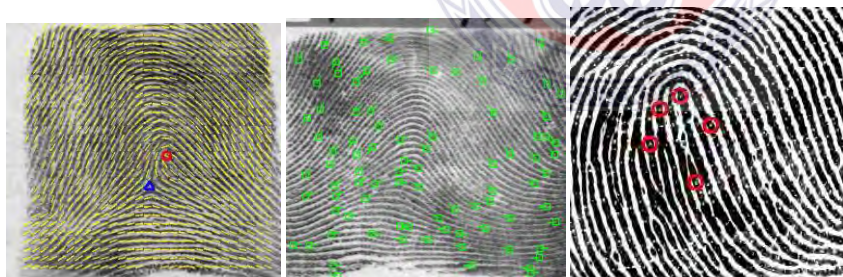


Figure 2: Examples of features in the three levels

Examples of fingerprint features belonging to the three levels are: (a) orientation field and singular points and (b) minutiae shown in fingerprints from NIST Special Database, and (c) sweat pores shown on part of a rolled print image from the WVU Latent Database. The Level 1 feature is the coarsest level representation and consists mainly of the ridge orientation map and ridge frequency map of the fingerprint.

2.7.2 Matching

Most published fingerprint matching algorithms are based on minutiae. A few techniques are based on image correlation methods. In the latter, the features are mostly the pixel intensities (Bazen et al., 2000). In this case, the correlation between two fingerprint images is computed for alignment, which can be performed globally or locally. The images of different impressions of the same finger might appear very different due to pressure variations (ridge thickness, contrast, global structure), which largely affects the correlation between two images. Also, the methods included in this category might be computationally very expensive (Jain et al., 2011).

Alignment based on the Generalized Hough Transform consists of finding the peaks in the parameter space associated with the rigid transformation between the two sets. In this case, each pair of minutiae (one in each fingerprint) will vote for a specific set of translation and rotation parameters computed as mentioned above (Ratha et al. 1996). Then, the peak in the parameter space (Hough Transform) is obtained usually more than one peak is selected for robustness. After the fingerprints are aligned, the pairing consists of finding the minutiae correspondences between the two fingerprints. The simplest way of finding the correspondence is to consider a pair of minutiae as matched minutiae if the distance between them and their directional difference are smaller than some pre-specified thresholds (15 pixels in translation and 20° in rotation).

2.8 Prospects and Challenges of Biometric

In perspective of Hollingsworth (2008) study, biometric is the procedure of recognizing a man in view of physiological or behavioural attributes. Biometric can be utilized as a part of no less than two distinct sorts of utilization. In a check situation, a man guarantees a specific personality and the biometric framework are utilized to confirm or reject the case. Confirmation is finished by coordinating a biometric example obtained at the season of the

case against the specimen beforehand selected for the guaranteed character. In a distinguishing proof situation, a biometric example is procured with no related character case. The undertaking is to recognize the obscure specimen as coordinating one of an arrangement of already selected known examples. The arrangement of enlisted specimen is frequently called an exhibition, and the obscure example is regularly called a test. The test is coordinated against the majority of the passages in the display, and the nearest match, expecting it is sufficiently close, is utilized to distinguish the obscure example. Like the confirmation situation, there are four conceivable results (Hollingsworth, 2008).

Moreover, a genuine constructive happens when the framework says that an obscure specimen coordinates a specific individual in the exhibition and the match is right. A false constructive happens when the framework says that an obscure specimen coordinates a specific individual in the display and the match is not right. A genuine negative happens when the framework says that the example does not coordinate any of the passages in the exhibition, and the specimen actually does not. A false negative happens when the framework says that the example does not coordinate any of the sections in the display, yet the specimen indeed does fit in with somebody in the exhibition (Hollingsworth, 2008).

No biometric arrangement will be 100% protected, yet when contrasted with a PIN or a secret word, biometrics may offer a more noteworthy level of security (Carrillo, 2003). Biometric, all in all, holds an arrangement of prospects and difficulties. The prospects exceed the difficulties fundamentally on account of the first point, biometric gives positive ID. A definitive objective is to have the capacity to acquire positive distinguishing proof without having any questions. Since one cannot lose, overlook, or share their biometric data, then it is known decidedly that the important data cannot be distorted. In spite of the fact that it is exceptionally hard to misrepresent a biometric attribute of an approved client, biometric (e.g. a face or unique mark) is not so much kept a mystery. Case in point, our fingerprints are left

in a wide mixed bag of spots in a given day, for example, at our homes and in the workplace (our fingerprints are everywhere on our PC consoles, mice, and espresso mugs) (Carrillo, 2003).

When a man has their organic qualities put into a format for later recognizable proof/check, it is realized that the layout is remarkable to that one person. Contingent upon the biometric strategy that is actualized, distinguishing proof/confirmation can happen in a matter of seconds or microseconds. This time likewise relies upon the sort of framework that the director is utilizing. In spite of the fact that the thought of computerized distinguishing proof is genuinely new, there is a lot of rivalry today with comparable items, which drive these organizations to bring down the expense when all is said and done (Carrillo 2003).

Open acknowledgment is the most critical issue when actualizing another framework or techniques by which one stands. In the event that people in general does not acknowledge the thought of biometrics, it is hard to execute effectively in light of the fact that it would not be utilized. There is an extensive rundown of legitimate issues that biometric force. As per Carrillo (2003) study, integrating a biometric framework into a domain where validation is fundamental is simple if shiny new frameworks were incorporated to simply do that (i.e. actualizing just unique mark scanners in the flight deck). There may additionally be existing frameworks that the integrator may need to update. Equipment expenses will without a doubt increment and that may turn into a downside for an organization or endeavor to utilize biometric as a method for recognizable proof/validation. The expense of new innovation will dependably turn into an issue. Capacity allocation of biometric formats will likewise build and may represent an issue with the individuals who may not include adequate measure of capacity at the present time.

Unique mark checking offers an exceptionally secure method for recognizable proof in a cheap way. The main hindrance is that there is contact with a general filtering gadget that

may spread germs. Basically offering antibacterial purifying arrangement previously, then after the fact the individual sweeps his/her finger may ease this issue. One may likewise generalize fingerprinting as a method for recognizing offenders in spite of the fact that the sort of fingerprinting done here is by advanced means (e.g. a checking gadget as opposed to customary ink and paper). Despite the fact that hand geometry checking is not as one of a kind as fingerprints, this innovation may force a superior method for recognizable proof, for example, vein structure, which is pretty much as novel as a unique finger impression. Both retina and iris based filtering strategies are exceptionally precise and hard to trick. Since the retina remains moderately steady amid a lifetime, exactness can be refined with little contemplated natural factors (Woodward, Orlans & Higgins, 2003).

2.9 Environmental Issues Affecting Biometric Modalities

In this segment each of the distinguished natural issues might be examined concerning every methodology of hobby. In 2007, the Defense Science Board (DSD) made the accompanying proposal: Given the normal development of biometric applications and utilization case situations, guarantee that field-use biometric gathering and examination frameworks are composed to function viably over the entire scope of physical situations. In the event that there are situations where the essential science included denies or hinders this, recognize and record these for the advantage of operational organizers (Defense Science Board (DSD), 2007).

2.9.1 Cold Temperatures

By and large, any biometric example obtaining device that requires the introduction of skin is gambling operational issues in chilly and extreme cool situations, which incorporates the administrator of the device and the subjects of hobby. Frostbite turns into a genuine danger at - 13° F (Environment Canada, 2010). In colder handled situations the obtaining device should

be composed in a manner that a vigorously gloved administrator will have the capacity to deal with a procurement session with one or more subjects. Enlistment would oblige skin introduction, which would not look good in either a helpful or uncooperative populace. Skin should regularly be uncovered for enlistment with the accompanying modalities of interest: unique mark, palm print, hand vein and face. The gathering device should be assembled to withstand long exposures to cool temperatures. Batteries are a particular sympathy toward convenient accumulation devices, which was an issue in Afghanistan (Environment Canada, 2010).

Moreover, Energizer (2008) contended that, cycling in the middle of warm and cool temperatures lessens the lifespan of a battery. The logistical impact that batteries have in chilly situations, when contrasted with ordinary situations, is that troops would need to convey more batteries to perform a comparable biometric securing errand, and they would need to have more substitution batteries available to them. These issues can conceivably be overcome by utilizing battery innovation that is less influenced by frosty temperatures (on the off chance that they exist), or by different intends to keep the batteries hotter than nature (Energizer, 2008). It has been accepted that cool fingers influence the nature of a unique mark securing in light of the fact that a decent quality print obliges flexible skin, which may not be the situation if fingers are icy and solid (Energizer 2008).

2.9.2 Hot Temperatures

One study incorporated the open air utilization of biometrics amid summer months. The study utilized optical and strong state sensors to procure the unique finger impression pictures. The strong state sensor got "insufferably hot to touch (Stewart, Estavao& Adler, 2009). On the other hand, this study had a settled establishment outside an entryway for access control, yet it does point out that a device with strong state sensors ought to have a necessity for a spread

to shield it from delayed direct daylight. The same can be said for any sensor that obliges human touch to finish the securing. The Marine Corps has reported that some biometric hardware endured breakdowns in the warmth in light of the fact that they were not ruggedized for great temperatures (MEF Town corridor gathering, 2008).

2.9.3 Dust and Sand

Biometric hardware that will be utilized as a part of the field ought to be constructed to withstand dusty situations. The Marine Corps has reported that some biometric hardware endured breakdowns in sandy conditions on the grounds that they were not adequately ruggedized. MEF Town lobby gathering (2008) reports contended that, blowing sand in a dry domain can bring about a development of electrostatic vitality, which can bring about shorts in touchy electrical gadgets. Due to the bigger particles, blowing sand may not get into little openings of gadgets like dust can, yet sand can be exceptionally rough to uncovered things, particularly scratch capable things, for example, the glass of a camera lens or the plate of a unique mark sensor. Messy conditions can make it hard to get a decent procurement of a few modalities. The valleys between unique mark edges can get filled in with soil, making it hard to recognize edges and their details when utilized with numerous sorts of sensor. Dormant fingerprints can be influenced by dust and sand, negligibly covering them from perspective.

2.9.4 Humidity

As per Butler (2005) study, to dodge the buildup issue, damp specimens should be air-dried before bundling. All examples ought to be fixed in paper-based compartments and put away in a dry domain. Steward (2005) contended that, if DNA tests are taken as a feature of an indoor enlistment then dampness is not as hazardous, but rather open air accumulation in the field requires fitting gear and preparing to raise the probability that the specimens to be of

worth when they get to the lab. At the point when in-the-field DNA preparation can occur later on, then this taking care of issue will be alleviated. In exceedingly sticky situations inert fingerprints debase rapidly on permeable surfaces.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used in conducting the study. The areas explored include the population of the survey, the sample size and sampling technique, the research approach, sources of data and data collection instruments and method of data analysis.

3.2 Research design

The research was based on quantitative approach to evaluate the biometric registration system within NHIA. The study adopted quantitative approach based on the assumption that, analysis in numbers and statistics are unbiased and reliable (Jacob, 1988).

3.3 Population of the Study

The population for the study comprises all clients and scheme operators under the Bantama District office of NHIA, Kumasi Ashanti. The District office is made up of three main areas: Kwadaso, Nhyiaeso and Bantama. Total registered members under the scheme are divided under two classifications active and inactive members. Active members are those whose cards or membership with the scheme are valid so they can access health care; and inactive members are members whose membership have expired or are on waiting period and so they cannot access health care. Table I below shows the population the sample size which was used for the study.

Table 1: Population and sample size

	Category of respondents	Population	Sample
Bantama	Clients	41,657	60
Kwadaso	Clients	29,048	45
Nhyiaeso	Clients	24,728	45
BSMHIS	Scheme operators	21	10
Total population and sample size		95,454	160

Source field study, April, 2017.

3.4 Sampling Technique

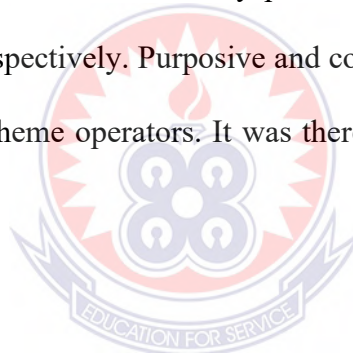
A sample is a portion of the population selected for analysis. For the purposes of this study, purposive or judgmental non-probability sampling technique was mainly used. The two judgmental sampling techniques that the researcher used were expert sampling and snowball sampling. Judgmental sampling was used to select the samples used for this research because the researcher needed to ensure that respondents in the sample have the required knowledge or expertise, as such, would be appropriate for the study and also would ensure a fair representation of the population of interest.

Expert sampling involves the assembling of a sample of persons with known or demonstrable experience and expertise in a specific area. The researcher adopted this technique for non-management staff because it was the best way to elicit the views of persons who have specific expertise in the topic area and also to provide evidence for the validity of the report. Snowball sampling relies on referrals from initial subjects to generate additional subjects (Goodman, 1961). This technique was used in order to reduce search cost and also to ensure that sample includes respondents who are knowledgeable or are experts in the research area. Scheme operators and clients of NHIA were selected through the purposive sampling

technique. This technique allowed the researcher to select respondents who had the capacity to handle the issue being studied. It was therefore impossible for the sample size to reflect on the whole population.

3.5 Sample size

The sampled size of one hundred and sixty (160) respondents consisting of a hundred and fifty (150) clients and ten (10) scheme operators was used for the study. Purposive sampling and convenient sampling technique was used to select the number of respondents from each of the three main areas under the study site. Since the Bantama area is comparatively paramount in terms of the sizes of the three areas, forty per cent (40%) of the total sample for the study was selected from the area so that thirty per cent (30%) each was selected from Kwadaso and Nhyiaeso areas respectively. Purposive and convenient sampling technique was used to select the clients and scheme operators. It was therefore impossible to reflect on the whole population.



3.6 Data collection

Data collection sources for the study comprised both primary and secondary Primary data for the study was collected through questionnaires while secondary data was collected from the scheme's archives. Questionnaires were employed in collecting the primary data because each respondent was asked to respond to the same set of questions. This provided an efficient way of collecting responses from a large sample and as such it had a high response rate

3.7 Design of the questionnaires

The questionnaire was designed in order to enable the researcher accomplish the research objectives. The information that was needed but could not be obtained from secondary source was translated into a set of questions. In order to improve the response rate and ensure that respondents feel very comfortable when answering the questions, the questionnaire did not require respondents to reveal their identity. A draft questionnaire was presented to the thesis supervisor so that any shortcoming or weakness in the questionnaire was corrected before the final version administered. It was designed to solicit the expert opinions of scheme operators and clients of NHIA who were primarily involved in matters of biometric registration.

3.8 Data analysis procedure

Data was analyzed with SPSS 16.0 version and Microsoft Office Excel 2007 to obtain frequencies, percentages of closed ended responses and graphs. This was to identify trends that appeared from responses. Descriptive statistics and other regression concepts were employed to justify the responses of management and non-management (staff). The higher the value of the mean, the higher the disagreement with the statement the key is as follows: 1 = strongly agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = strongly disagree.

3.9 Profile of the Organization

The fundamental structure for the Health Insurance system in Ghana is assembled in the National Health Insurance Act, 2003 (Act 650), which has been revised to the National Health Insurance Act, 2012 (Act 852). The dream of the NHIS in Ghana has been the assurance of enabling equitable worldwide access to health-care for all inhabitants of Ghana to a package of essential health services of a satisfactory quality without payment being mandatory at the point of service (NHIP, 2004). The Act recognized a National Health Insurance Authority (NHIA), governed by a Council, to control the health-care system,

including the accreditation of providers, agreeing contribution rates with the schemes, administrating the operations of the schemes and National Health Insurance Fund. The Health Insurance Act authorizes the institution and operation of three types of health insurance schemes in the country, namely District Mutual Health Insurance Schemes (DMHIS), Private Commercial Health Insurance Schemes (PCHIS) and Private Mutual Health Insurance Schemes (PMHIS) (NHIS Act 650, 2003).

3.9.1 District Mutual Health Insurance Schemes (DMHIS)

For the betterment of the Ghanaian citizens, DMHIS have been recognized across every district in Ghana. At present one hundred and forty five (145) district schemes operate in Ghana. Clients within the schemes are expected to settle assistance outlined by the scheme in accordance to the regulations by the Authority. Nevertheless, exclusions is decided to indigents, SSNIT pensioners and contributors of SSNIT whose monthly contributions amount to or surpass the minimum monthly contribution mandated under the DMHIS. “The support of the scheme comes from the National Health Insurance Authority in the form of subsidy for the excluded group and imbursement of salaries for staff” (Bernard, 2011). The processes of the schemes are monitored by the authority via the regional offices and Care Taker Committees. The scheme has a management team encompassing the Scheme Manager, Accountant, Claims Manager, Management Information Systems Manager (M.I.S), Marketing Manager/PRO and Data Entry Officer who are responsible for the day to day running of the scheme” (Bernard, 2011).

3.9.2 Private Mutual Health Insurance Scheme (PMHIS)

The PMHIS is being operated by any set of citizens’ inhabitant in Ghana. This scheme type operates absolutely for the advantage of it associates and does not essentially have a focus

district. It is either a community based, occupational or faith based that does not receive subsidy from the government (Ghana Ministry of Health, 2004a).

3.9.3 Private Commercial Health Insurance Scheme (PCHIS)

The PCHIS is viewed as a limited liability company under then Ghanaian company's code and measured as an industry venture that operates for profit on the basis of market principles. PCHIS premiums are based on risk calculated from a specific groups and clients who pledges to the scheme. Consequently, individuals with higher risk settle more. The possession of PCHIS exists within the business and its shareholders. The Ghana Ministry of Health supplies its associates with identity cards that enhance them to access minimum pre-scribed health-care advantages (GMOH, 2004).



CHAPTER FOUR

RESEARCH FINDINGS AND RESULTS

4.1 Introduction

The findings of this study indicate that the National Health Insurance Scheme (NHIS) is a machinery of health care financing that does not prevent the poor and helpless from accessing health-care when the need arises. The Scheme is focused at tackling the difficulty of financial obstacles to health-care admission within the frame work of the Ghanaian Poverty Reduction Strategy (GPRS). The policy's reason was to establish a NHIA that will guarantee that all resident of Ghana fit in to a health-care insurance scheme that sufficiently wraps a person the need to settle payment at the point of service. Furthermore, the NHIA is executed as a reaction to the decreasing rate of health-care utilization due to the cash and carry method. The aim of the NHIS excuses the excessive deprived from contributing and enabling the deprived to settle less than the rich so as to enable the poor to health-care service (National Development Planning Commission, 2009).

4.2 Biometric registration policy

4.2.1 Why the biometric registration was introduced

The introduction of the biometric registration system was to check double registration, ensure data integrity and instant access to NHIA identification cards and to address the problem of identification cards distribution. Again, it took several months close to nine month before clients could gain access to their identification cards.

4.2.2 Sponsors of the new biometric registration system

NHIA is the sponsor of the new system according to the findings.

4.2.3 Social issues with the new biometric registration system

According to the findings the public indicated that the process was too cumbersome and sometimes can delay you for the whole day.

4.2.4 Perceived technological problems

The main technological problems according to the findings were consistent network failure which sometimes last for the whole day. Despite the problems, the new biometric registration system has helped resolve the problems that characterized the previous system. Thus the new biometric system was better than the old one.

4.2.5 Assessment biometric registration system

The findings suggested that, the NHIA has a biometric registration policy and that the process includes registration, payment of premiums and processing fees, bio data entry captured together with fingerprint scanning, photo taken and identification cards printed instantly.

4.2.6 Challenging section of the biometric registration system

Capturing of data was considered most challenging according to the findings as there are consistent network connectivity failures.

4.2.7 Challenges of the biometric registration system

According to the findings, frequent network failure, lack of adequate consumables, high cost of system upgrade and long-queues generated by clients.

4.8 Introduction

The chapter presents the analyses of data in relation to the biometric registration system adopted by NHIA in Ghana. Using SPSS statistical tool and Microsoft Excel, the results of the data analysis are represented in tables and graphs. One hundred and sixty-five (165)

questionnaires were administered to the respondents (Scheme operators and clients of NHIA) and 160 retrieved after a week of administering. Items that were not answered on the questionnaires were treated as missing. The chapter begins with Background information analysis on respondents.

4.9 Background information analysis on respondents

This section provides the background information analysis of respondents. The information discussed includes age, gender, educational background and number of years of respondent's relationship with NHIA. Background information analysis of respondents was very critical in assisting the researcher identifies the target market for staff, the cost controlling strategy adopted by the NHIA and the trend of retention rate of the company's workforce. The results are represented in the graphs below.

4.9.1 Age of respondents

From figure 1 below, 23.8% of the respondents within the NHIA had their ages below 25 years whereas only 7.5% had their ages above 45 years. The most dominant age ranges was below 25 years with 23.8% of the respondents indicating the workforce culture of the banks. The companies target staffs possibly are on the youth. The last group in the age distribution table was between 36-40 years who recorded 16.8%.

Table 2: Findings on Data Write-up

Variables	Percentage Frequency
Gender	
Male	60.3
Female	39.7
Age (Years)	
25 and below	23.8

25 – 35	16.8
45 and above	7.5
Client Status	
Informal (fully paid)	49.00
SSNIT Contributor	40.00
Indigent	05.00
SSNIT Pensioner	02.00
Aged (Over 70yrs)	04.00
Duration with Scheme	
One year	13.00
Two years	10.00
Three years	27.00
Four years	11.00
Above four years	39.00
Effectiveness of the biometric registration	
Very Effective	50
Effective	25
Not effective	8
Not effective at all	17
Educational qualification	
HND	59
First degree	30
Second degree	7
Above second degree	4

4.9.2 Gender of respondent

Table 2 above shows that 60.3% of the respondents are female with males covering about 39.7% of the respondents. However the dominant nature of high female participants reflect the workforce culture of the respondents. Thus the NHIA staff is dominated by women.

Table 2: Findings on Data Write-up

Variables	Percentage Frequency
Gender	
Male	60.3
Female	39.7
Age (Years)	
25 and below	23.8
25 – 35	16.8
45 and above	7.5
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Effectiveness of the biometric registration	
Very Effective	50

Effective	25
Not effective	8
Not effective at all	17
Educational qualification	
HND	59
First degree	30
Second degree	7
Above second degree	4

Source field study, April 2017

4.9.3 Number of years of respondent relationship with NHIA

As indicative of table 2 above, respondents who had 3-4 years relationship with the scheme formed about 90% of the total while those above 5 years is about 40%. This indicates that National Health Insurance Authority has a high management retention rate. This may be attributed to its effective and quality motivational packages design for its staff, corporate image and proper management of staff. Alternatively it can be established that the retention rate of staff is relatively high.

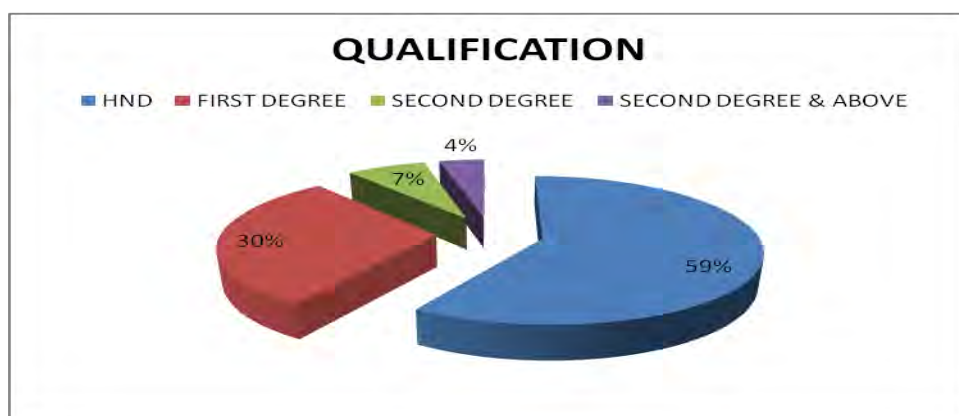


Figure 3 Educational background of respondent

Source field study, April 2017

4.9.4 Educational Background of Respondent

The educational background of the respondent represented in table 2 above indicates that 59% of the respondents are HND leavers with first degree following with 30% of the respondent. The least in this category are those above second degree. This group covers only 4% of the respondent. The dominant nature of HND leavers reveals the target market of the company's staff. The outcome also indicates that the workforce cultures of NHIA are mainly HND holders. There is an implication that, the organization employs cost cutting strategy in its operations. Thus the NHIA is able to pay less as compared to employing degree and above holders thus consequently conserving cash for other project activities.

4.10 Examining the biometric registration process of NHIA

In the quest to examining the biometric registration process at NHIA, respondents were asked to indicate their preference by either strongly-agree, agree, neutral, disagree, strongly-disagree on the various statements pertaining to the process of biometric registration that includes enrollment, fingerprint, authentication or verification, identification and authentication token stages. Their responses are analyzed and presented in the descriptive statistics table below:

Table 3: Descriptive Statistics on the biometric registration process of NHIA

	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's alpha
Enrollment	160	1.00	4.00	1.7600	.63012	0.67
Fingerprint	160	1.00	5.00	2.3800	.97576	
Authentication	160	1.00	4.00	2.0133	.77145	
Identification	160	1.00	5.00	2.4433	1.42146	
Authentication card	160	1.00	4.00	2.0867	.75789	
Valid N (listwise)	160					

4.10.1 Reliability Test

Statistically, the Cronbach's alpha is a standard tool used in measuring the internal consistency and reliability of data that is based on multiple Likert questionnaires scale. It can be inferred from table 3 that Cronbach's alpha is 0.67 that signify a moderate degree of internal consistency and reliability for the scale.

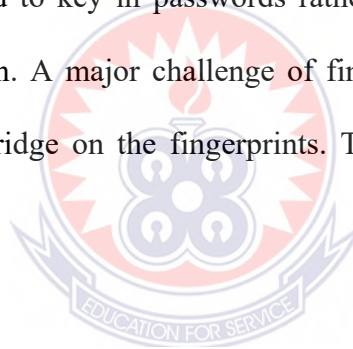
4.10.2 Enrollment process

In examining the biometric registration process of NHIA, respondents agreed with the statement that enrollment was the first stage in the process. Thus enrollment involves the registration of a certified client into the system. This was a process considered as one spot process often measured as the significant and challenging part of the process. The value of the produced position outline at enrollment decides the efficiency of the system throughout

its usage. The registration requires the attendance of the client in various security inclined functions to confirm the value of the sample within the database. Lastly the enrollment was carried out in a safe atmosphere, preventing potential harassments. The mean for this item was 1.76 approximately 2.

4.10.3 Finger Print Process

Furthermore, in examining the biometric registration process of NHIA, respondents agreed with the statement that fingerprint assessment was the second stage in the process. Thus the biometric tool employs the frictional ridges outline on a client's fingertips. The outline is measured as distinctive to a particular client. The identical fingers of identical twins also differ. Clients are not expected to key in passwords rather a tap to the fingerprint device enables an immediate admission. A major challenge of fingerprint device was with clients that have a defective outlined ridge on the fingerprints. The mean for this item was 2.38 approximately 2.



4.10.4 Verification Process

Moreover, in examining the biometric registration process of NHIA, respondents agreed with the statement that authentication was the third stage in the process. Thus indicating that, verification was the procedure of contrasting an identified biometric test to an establish test recognized in a database. This was a one-to-one process and is commonly employed in identifying credentials including business badges; National Identification cards Passports, to confirm whether the holder is the legitimate owner of the credential. The mean for this was 2.01 approximately 2.

4.9.5 Identification Process

Again, respondents agreed with the statement that, identification was the fourth stage of the process. Thus further indicating that, Identification was the one-to-many process of contrasting an unidentified biometric test to a multiple tests within a database to establish the uniqueness of the holder of the unidentified test. Positive identification was referred to as confirming the association of a group whereas negative authentication indicates confirming the non-membership of a group. This process was carried out before registering the new client. The mean for this item was 2.44 approximately 2.

4.9.6 Authentication token (identification card)

Additionally respondents agreed with the statement that, granting of identification cards or token was the final stage of the process. Thus further indicating that, identification card is a verification card. One essential characteristic of the identification card was that, it cannot be easily forged or copied and was the visa to access healthcare service.

4.10 Examining the challenge that confronts the success of biometrics registration process of NHIA.

As indicated in the literature review, despite the significance revealed by biometric technologies, it is still pose with challenges that has the potential of confronting the success of the application of biometric technology. In the quest to assess the challenges of biometric registration, respondents (Scheme operators) were asked to indicate their preference by either indicating strongly agree, agree, neutral, disagree and strongly disagree on the various statements pertaining to biometric challenges. Their responses were analyzed and presented in the descriptive statistics table below (Table 4)

Table 4: Descriptive statistics on the challenge that confront the success of biometric registration process of NHIA

	Network failure	Shortage of consumables	High cost	Long-queues
Valid	100	100	100	100
Missing	0	0	0	0
Mean	1.0300	1.6800	1.7300	4.0700
Median	2.0000	2.0000	4.0000	4.0000
Mode	2.00	2.00	4.00	4.00
Std. Deviation	.80221	.67987	.78438	.86754

Table 4: above indicates that, frequent network failure was one of the major challenges confronting the success of biometric registration. Thus uncertainties surrounding the network break down causes frustrations and uneasy working environment for staff. Again, clients become agitated and begin to question the capabilities of management. The mean for this item was 1.03 approximately 1.

Similarly, table 4 above indicates that a frequent shortage of consumables was also a major challenge. Consumables including cards, papers printing inks and other biometric accessories frequently get shortage causing frustrations and uneasiness on both sides of clients and scheme operators. There is also delay in replacing these consumables on the side of management. The mean for this item was 1.6 approximately 2.

Moreover, respondents agreed that, there was a challenge of high cost. Thus, integrating a biometric system into an environment where authentication is necessary was easy if brand new systems were integrated. However, there was also an existing system that the integrator

might want to upgrade. Hardware costs were definitely increasing and that caused a drawback for the use of biometric as a means for identification or authentication.

The cost of new technology was always an issue. Storage allocation of biometric templates will also increase and may pose a problem with those who may not what comprise sufficient amount of storage at the current time.

Finally respondents disagreed that the biometric registration employed had no long-queues challenge. Thus, the problem of frequent shortage of consumables, frequent network breakdown causes clients to wait in long hours before being served. This situation cause's biometric registration to be a very long hurdle to jump even though it prospects outweighs the challenges. The mean for this item was 4.0.

4.11 Examining the prospects of biometric registration system at NHIA

As indicated in the literature review, biometric registration system possess some future prospect despite its challenges. This prospects when realized have a potential of benefiting the Scheme on a long-term basis. Seven statements pertaining to biometric registration system were posed to respondents on how they perceive the prospects. Their responses are analyzed in table 5 below.

Table 5 Descriptive Statistics on prospects of biometric registration system at NHIS

	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's alpha
1. positive identification	160	1.00	2.00	1.7230	.45432	0.66
2. valuable information cannot be falsified	160	1.00	5.00	2.9391	.89135	
3. template is unique to that one individual	160	1.00	2.00	1.3913	.49018	
4. Lower the cost in general.	160	1.00	4.00	2.0174	.74907	
Valid N (list wise)	160					

Source: field study, April, 2017.

The prospects exceed the difficulties principally in light of the fact that at first point, biometric gives positive recognizable proof. Along these lines respondents concurred that; a definitive objective is to have the capacity to get positive distinguishing proof without having any questions. Again respondents concurred that, since one cannot overlook, or share their biometric data, then it is known decidedly that the profitable data cannot be misrepresented. Despite the fact that it is exceptionally hard to misrepresent a biometric quality of an approved client, biometric (e.g. a face or unique mark) is not so much kept a mystery. Case in point, our fingerprints are left in a wide mixed bag of spots in a given day, for example, at our homes and in the workplace (our fingerprints are everywhere on our PC consoles, mice, and espresso mugs).

Additionally respondents concurred that, once a man has their organic attributes put into a layout for later recognizable proof/confirmation, it is realized that the format is one of a kind to that one person. Contingent upon the biometric system that is executed, distinguishing proof/confirmation can happen in a matter of seconds or microseconds. This time relies on

the kind of framework that the director is utilizing. In conclusion, in spite of the fact that the thought of advanced distinguishing proof is genuinely new, there is a lot of rivalry today with comparative items, which drive these organizations to bring down the expense all in all.

4.12 Effectiveness of biometric registration system adopted by NHIA.

From figure 5 above, 50% of the Scheme operators of NHIA did indicate that the biometric registration system was very effective in the enhancement of the performance of the company. Twenty five percent (25%) of management of NHIA also agreed to the fact that biometric registration system was effective enough in enabling the organization achieves its stated objective. It could be seen that 17% agreed that, the biometric registration system of NHIA was not effective in the enhancement of the performance of the company to with very few as low as 8% agreeing that biometric registration system was not effective at all in the enhancement of the company achieve a good corporate image.

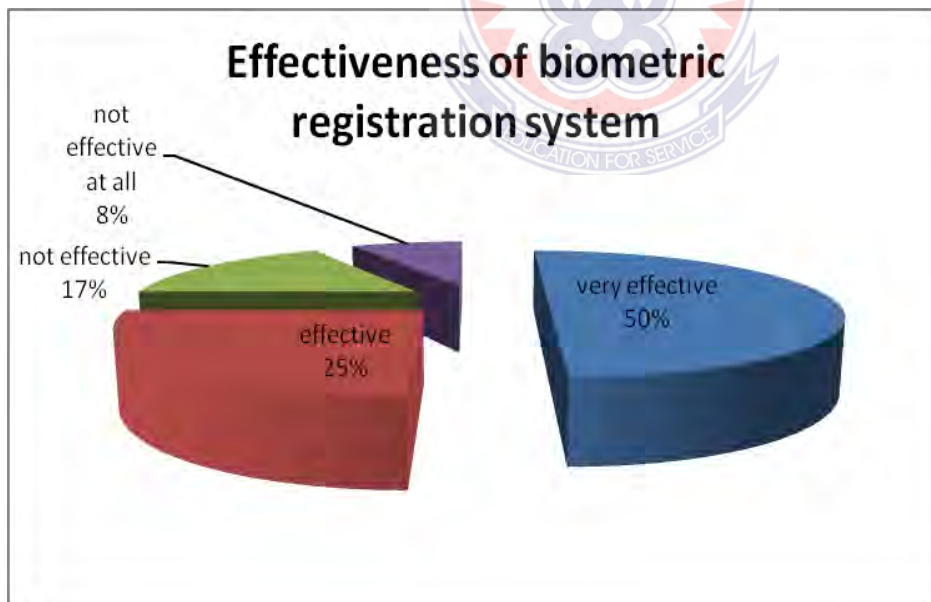


Figure 5 Effectiveness of biometric registration system adopted by NHIA.

The results therefore suggested that the biometric registration system of NHIA was very effective in the enhancement of the performance of the company and also enabling the institutions achieve good corporate image. The results again suggest that, the biometric registration system was experiencing some setbacks in its operations.



CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

The chapter presents the summary of the main findings of the study with special focus on the four objectives. The chapter ends with, conclusion and recommendations which have been made based on the findings of the study.

5.2 Summary of key Findings

5.2.1 Examining the effectiveness of biometric registration system adopted by NHIA.

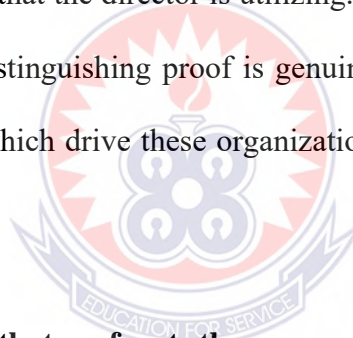
The analysis revealed that, majority of the Scheme operators of NHIA did indicate that the biometric registration system was very effective in the enhancement of the performance of the company. Some of the Scheme operators of NHIA also agreed to the fact that biometric registration system was effective enough in enabling the organization achieve it stated objective. Few also agreed that, the biometric registration system of NHIA was not effective in the enhancement of the performance of the company with very few agreeing that biometric registration system was not effective at all in the enhancement of the company to achieve a good corporate image. The results therefore suggested that the biometric registration system of NHIA was very effective in the enhancement of the performance of the company and also enabling the institutions achieve good corporate image. The results again suggest that, the biometric registration system was experiencing some setbacks in its operations.

5.2.2 Examining the prospects of biometric registration process

The analysis further revealed that, the prospects exceed the difficulties principally in light of the fact that biometric gives positive recognizable proof. Along these lines respondents concurred that; a definitive objective is to have the capacity to get positive distinguishing proof without having any questions. Again respondents concurred that, since one can't lose,

overlook, or share their biometric data, then it is known decidedly that the profitable data cannot be misrepresented. Despite the fact that it is exceptionally hard to misrepresent a biometric quality of an approved client, biometric (e.g. a face or unique mark) is not so much kept a mystery. Case in point, our fingerprints are left in a wide mixed bag of spots in a given day, for example, at our homes and in the workplace (our fingerprints are everywhere on our PC consoles, mice, and espresso mugs).

In addition respondents concurred that, once a man has their organic attributes put into a layout for later recognizable proof/confirmation, it is realized that the format is one of a kind to that one person. Contingent upon the biometric system that is executed, distinguishing proof/confirmation can happen in a matter of seconds or microseconds. This time additionally relies on the kind of framework that the director is utilizing. In conclusion, in spite of the fact that the thought of advanced distinguishing proof is genuinely new, there is a lot of rivalry today with comparative items which drive these organizations to bring down the expense all in all.



5.2.3 Examining the challenge that confronts the success of biometric registration process of NHIA.

According to the analysis, frequent network failure was one of the major challenges confronting the success of biometric registration. Thus uncertainties surrounding the network break down cause frustrations and uneasy working environment for staff. Similarly, clients become agitated and begin to question the capabilities of management. Additionally, respondents agreed that, a frequent shortage of consumables was also a major challenge. Consumables including cards, papers printing inks and other biometric accessories frequently get shortage causing frustrations and uneasiness on both sides of clients and scheme operators. There is also delay in replacing these consumables on the side of management.

Moreover, respondents agreed that, there was a challenge of high cost. Thus, integrating a biometric system into an environment where authentication is necessary was easy if brand new systems were integrated to just do that. There was also an existing system that the integrator may want to upgrade. A hardware cost was definitely increasing and that caused a drawback for the use of biometrics as a means for identification or authentication.

Finally, respondents disagreed that the biometric registration employed had no long-queues challenge. Thus the problem of frequent shortage of consumables, frequent network breakdowns cause clients to wait in long hours before being served. This situation cause's biometric registration to be a very long hurdle to jump even though it prospects outweighs the challenges.

5.2.4 Examining the biometric registration processes of NHIA

Enrollment was found to be the first stage in the registration process of NHIA. Enrollment involves the registration of a certified client into the system. This was a process considered as one spot process often measured as the significant and challenging part of the process. The value of the produced position outline at enrollment decides the efficiency of the system throughout its usage. The registration requires the attendance of the client in various security inclined functions to confirm the value of the sample within the database. Indeed enrollment was carried out in a safe atmosphere, preventing potential harassments.

Similarly, fingerprint assessment was the second stage in the process. Thus the biometric tool employs the frictional ridges outline on a client's fingertips. The outline is measured as distinctive to a particular client. The identical fingers of identical twins also differ. Clients are not expected to key in passwords rather a tap to the fingerprint device enables an immediate admission. A major challenge of fingerprint device was with clients that have a defective outlined ridge on the fingerprints. The mean for this item was 2.38 approximately 2.

Moreover, authentication was the third stage in the process. Thus indicating that, verification was the procedure of contrasting an identified biometric test to an established test recognized in a database. This was a one-to-one process and is commonly employed in identifying credentials including business badges; National Identification cards Passports, to confirm whether the holder is the legitimate owner of the credentials.

Furthermore, identification was the fourth stage of the process. Identification was the one-to-many process of contrasting an unidentified biometric test to a multiple tests within a database to establish the uniqueness of the holder of the unidentified test. Positive identification was referred to as confirming the association of a group whereas negative authentication indicates confirming the non-membership of a group.

Finally, granting of identification cards or token was the final stage of the process. Thus further indicating that, identification card is a verification card. One essential characteristic of the identification card was that, it cannot be easily forged or copied and was the visa to access healthcare service.

5.3 Recommendation

The following are the recommendations presented by the researcher. First, prior to picking a suitable biometric method, one needs to judiciously research biometric performance measurements. These measurements are vital when we are matching security and convenience. Biometric weaknesses must be well-defined so that they can be mitigated before clever attackers use them.

Second, security worries need to be balanced with practical cost and operational deliberations as well as political and economic interests. A risk management method can help federal

agencies identify and solve security concerns. To advance security systems with biometrics, the high level goals of these systems need to be defined, and the concept of procedures that will embody the people, process, and technologies required to achieve these goals need to be developed. If these details are not determined, the estimated cost and performance of the resulting system will be at risk.

Finally, thought must be given to the convenience and ease of using biometric and their effect on the ability of the agency to complete its mission. For example, some people find biometric technologies difficult, if not impossible, to use. Still others resist biometrics because they trust them to be intrusive, intrinsically offensive, or just uncomfortable to use. Lack of cooperation or even resistance to using biometrics can affect a system's performance and extensive adoption.

5.4 Conclusion

Biometrics is a means of verifying personal identity by measuring and analysing unique physical or behavioural characteristics like fingerprints. The conclusion of this whole paper, the biometric registration system adopted by NHIA involves five stages including the enrolment, fingerprint, authentication, identification and the smart card stage. The study established that, biometric registration process is crippled with certain challenges that include frequent network failure, frequent shortage of consumables, high cost and long-queues created by clients. Though this system has many challenges it was effective with attractive prospects like identification of individual with unique finger, inability for ones information to be falsified and elimination of double registration of patient in the hospitals because of the introduction of verification machine at the various hospitals

5.5 Recommendation for further research

This research evaluated the biometric registration system adopted by NHIA in terms of its prospects and challenges. The sustainability and reliability of this system of registration are topics for future research and factors militating against the successful implementation of public procurement Act 663(2003) in NHIA.



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APPENDIX

Questionnaire (management)

This questionnaire seeks to evaluate the biometric system in the registration of NHIS subscribers with special focus on Bantama sub-metro office of the National Health Insurance Authority (NHIA) of Ghana. Please kindly assist us in this survey processes by filling the questionnaire given below. Please indicate your preference among alternative answers for each question by ticking in the appropriate box. Where alternative answers are not provided, fill in the gaps provided. Respondents are assured of the confidentiality of this exercise because it will be solely be used for academic purpose. Thank you for your contribution.

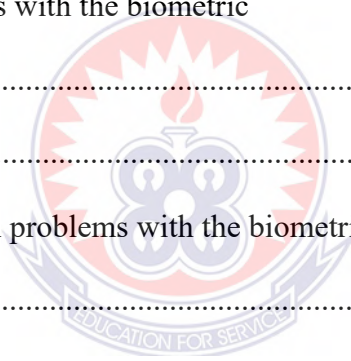
Name of researcher: Tony

A. Background Information of respondent

1. Gender? A. Male [] B. Female []
2. Age? 25 years and below [] Between 26 and 35 years [] Between 36 and 45years [] Between 46 and 55 years [] Above 55 years []
3. Position? A. Chief executive Officer [] B. Branch manager [] C. Scheme officer.
4. Educational qualification? A. J.H.S B. S.H.S C. Diploma D. Degree E. Masters
F. Masters and beyond
5. How long have you been working with NHIS?
A. Less than 1year [] B. Between 2 and 5years [] C. Between 5 and 10 years []
d. More than 10years []

B. Background of biometric registration policy

1. Why did management introduce the biometric system of NHIA?.....
.....
2. What was wrong with the earlier system?.....
.....
3. Who are the sponsors of the new system?.....
.....
4. Any perceptible social issues with the biometric system?.....
.....
5. Any perceived technological problems with the biometric system?.....
.....
6. Are there any security concerns with it?.....
.....
7. Has the biometric technique resolved the problems that characterized the previous system?.....
.....



C. Assessment of biometric registration system

8. Does the institution have a biometric registration process? Yes [] No []

9. What is the process of this biometric registration system?

.....
.....

10. Which section of the process is most challenging?.....

11. How effective is this biometric registration process for the institution? A. Very effective

B. effective C. not effective D. not effective at all E. if others

specify.....

12. What challenges generally confront the success of the biometric registration process?

.....
.....

13. What level of management is responsible for the formulation of the biometric registration system? Board [] Top management [] Junior staff [] if others

specify.....

14. How often do you receive subscriber's complaints?

Very often [] Often [] once a while [] Never []

15. How would you rate the biometric registration system adopted by the institution?

A. Excellent [] B. Good [] C. Average [] D. Poor []

16. What do you think are the benefits the institution stands to gain by adapting to this biometric registration system?

A. Good corporate image [] B. Positive word of mouth [] C. Increase in profit []

D. High clients retention [] E. all of the above []

Questionnaire (Subscribers)

This questionnaire seeks to evaluate the biometric system in the registration of NHIS subscribers with special focus on Bantama sub-metro office of the National Health Insurance Authority (NHIA) of Ghana. Please kindly assist us in this survey processes by filling the questionnaire given below. Please indicate your preference among alternative answers for each question by ticking in the appropriate box. Where alternative answers are not provided, fill in the gaps provided. Respondents are assured of the confidentiality of this exercise because it will be solely be used for academic purpose. Thank you for your contribution.

Name of researcher: Tony

A. Background Information of respondent

1. Gender? A. Male [] B. Female []
2. Age? 25 years and below [] Between 26 and 35 years [] Between 36 and 45years []
Between 46 and 55 years [] Above 55 years []
3. Type of subscriber? A. informal [] B. formal [] C. aged. D. dependants. E. pregnant woman. Others specify.....
4. Educational qualification? A. J.H.S & below B. S.H.S C. Diploma D. Degree E. Masters F. Masters and beyond
5. How long have you been a subscriber of NHIS?
A. Less than 1year [] B. Between 2 and 5years [] C. Between 5 and 10 years []
d. More than 10years []

B. Assessment of the satisfaction and effectiveness of biometric registration system adopted by NHIS.

6. Are you satisfied with biometric registration system adopted by NHIS? Yes [] No []

7. How long do you wait in queue in assessing the biometric registration system?
.....

8. How effective is this biometric registration system for you as a subscriber? A. Very effective B. effective C. not effective D. not effective at all E. if others specify.....

9. What challenges do you generally encounter when assessing the biometric registration system?
.....
.....

10. How would you rate the biometric registration system adopted by the institution?
A. Excellent [] B. Good [] C. Average [] D. Poor []

11. What do you think are the benefits the institution stands to gain by adapting to this biometric registration system?
A. Good corporate image [] B. Positive word of mouth [] C. Increase in profit []
D. High clients retention [] E. all of the above [] others please specify.....
.....

12. Compare the new system of registration to the old system of registration?
A. Much better B. Better C. not good D. not good at all