ADAPTATION OF BANKNOTE SECURITY FEATURES ON SOME AHMADU BELLO UNIVERSITY SENSITIVE DOCUMENTS FOR PROTECTION AGAINST COUNTERFEITING

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA. IN PARTIAL FULFILLMENT FOR THE AWARD OF MASTER OF ARTS DEGREE IN INDUSTRIAL DESIGN

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AUGUST, 2016

DECLARATION

I declare that the work in this dissertation entitled **"Adaptation of Banknote Security Features on some Ahmadu Bello University Sensitive Documents for Protection against Counterfeiting"** has been carried out by me in the Department of Industrial Design. The information derived from the literature has been duly acknowledged in the text and list of references provided. No part of this dissertation was previously presented for another degree or diploma at any other Institution.

Muhammad Bashir HASHIM _____ _____

Signature **Date**

CERTIFICATION

This dissertation entitled **"ADAPTATION OF BANKNOTE SECURITY FEATURES ON SOME AHMADU BELLO UNIVERSITY SENSITIVE DOCUMENTS FOR PROTECTION AGAINST COUNTERFEITING"** by **Muhammad Bashir HASHIM** meets the regulations governing the award of the degree of Master of Arts in Industrial Design of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

I dedicate this dissertation to almighty Allah Subbahanahu Wata'ala for giving me the grace, strength, and above all knowledge. Also to my late Father Malam Hashim Haruna Muhammad May his soul rest in peace and to my entire family with gratitude.

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OPERATIONAL DEFINITION OF TERMS

Within the context of this study the below terms simply means:-

Adaptation: Is the developmental process of modifying, adjusting or transforming an existing concept, technique or an idea for more usability.

Authentication: Are those features that make a paper document an original

Banknote: (often known as paper money, note or bill) is a valuable paper that is negotiable, payable and issuable by the banks as a legal tender.

Counterfeit: Is the act of creating or reproduction of a fake version of a genuine document or product to look alike with the original in order to perpetuate fraud.

Forgery: Is an act of illegal altering authentic document by changing of names, grade, years, rank, gender, registration numbers, figures, status, passport and or signature with the intent to deceive someone.

Protecting: Is the act of safeguarding sensitive paper documents from being forged or counterfeited.

Security features: Are those features that are incorporated on to valuable paper document in order to protect them against forgery and counterfeiting e.g. watermarks, invisible fibers in paper and so on.

Security printing: is a segment of the printing that deals with the printing of items such as banknotes, cheques, passports, tamper-evident labels, product authentication, stock certificates, postage stamps, identity cards and so on.

ABSTRACT

This study is aimed at adapting banknotes security features on Ahmadu Bello University's sensitive documents in order to protect them against counterfeiting. This aim was achieved through the following objectives: 1. to study banknote security features for onward adaptation on Ahmadu Bello University's sensitive documents. 2. To redesign some of the Ahmadu Bello University's sensitive documents by introducing multifarious security features on them. Primary data were collected based on an experimental research design and purposive sampling technique. Responses from the questionnaire were based on liker's 5-pointscale. For the purpose of this study, purposive sampling technique was used. The main reason for using purposive sampling technique was to enable the researcher focus on particular characteristics of the population that are of interest. For this reason, the researcher x-rayed 86 different banknote security features globally, out of which 15 were selected for adoption on Ahmadu Bello University sensitive documents. Additionally, a total number of the 49 copies of questionnaire for printers and graphics designers were distributed to the top five security printing companies in Nigeria. Simple percentage and frequencies was used to analyze the data collected via the questionnaires. The studio work procedures are based on the following headings. They are exploration, developmental and production stages respectively. This study revealed that most of the valuable paper documents in Nigeria have little or no security features on them especially in the area of ink and paper. Moreover, banknote remain the most secured valuable paper document all over the world, the following banknote security components such as; paper, non-commercially available security ink, design and printing technique can easily be adopted on Ahmadu Bello University's Sensitive documents for protection against forgery and counterfeiting.. These menaces have brought a great setback to national development. For this reason, there is need for serious and urgent efforts from graphic designers, researchers, indigenous ink producers, in-house paper mill companies and security printing industries to jointly tackle this ugly phenomenon for Nigeria to move forward. Finally, it's recommended that Graphic designers, researchers, indigenous ink producers, in-house paper mill companies and security printing companies should jointly tackle the ugly phenomenon of forgery and counterfeiting for Nigeria to move forward. Moreover, courses on forgery and counterfeiting, piracy, faking, documents theft, security features, ink production, and paper security should be introduced to graphic designers and printers to take care of the present technological development.

CHAPTER ONE

Introduction

1.1 Background of the Study

The advent of computer, direct imaging, desktop publishing and computerized image system that produces excellent color jobs make forgery and counterfeiting of sensitive paper documents easier and rampant. Today in Nigeria, counterfeiting and forgery of sensitive paper documents such as banknotes, certificates of occupancy, cheque books, statement of results, cash receipt, identity cards, letterhead papers, drivers' license, school certificates, passports, tamper-evident labels, stock certificates, postage stamps and so forth are on the increase.

The crime of Banknote counterfeiting is as old as making of Banknote itself (Giesecke & Devrient, 2015). In order to minimise the menace of forgery and counterfeiting of valuable paper documents, security features are developed by security printers and banknote paper makers. Banknote Security features can be classified into two types; that which can be seen by naked eyes and others that require the use of equipment like magnifying glass, Ultra Violet lamp, Infra-red viewer and so on.

According to Manisha and Gupta (2016) "most of the modern banknote consists of the following security features paper quality, security thread, gradient colouring, intaglio printing, UV glowing, micro texts, anti-copying mark, watermarks, infrared glowing and so forth". The study attempts to explore various anti-counterfeit methods and materials for adaptation on Ahmadu Bello University sensitive documents in order to identify the most possible effective method for minimizing counterfeiting in Ahmadu Bello University Zaria and Nigeria as whole.

International Chamber of Commerce (ICC, 2009), notes that "the international trade in counterfeit and pirated products costs the world economy about 250 billion US Dollars

annually". Moreover, this trend puts over 2.5 million legitimate jobs at risk in the G20 countries alone (ICC, 2009). Narrowing this to Nigeria, Global Intellectual Property Centre (GIPC) in the Guardian Newspaper (2015) notes that a yearly loss of N200 billion is attributed to forged and counterfeit products.

In line with the above, the immediate past Nigerian President, Dr. Goodluck Ebele Jonathan and his Former Nigerian Minister of finance, Dr. Ngozi Okonjo Iweala were at the formal presentation of new redesigned 100 Naira note to commemorate Nigeria's centenary, where "urged the Central Bank of Nigeria (CBN) to start printing Nigerian banknotes and other sensitive paper documents locally" (Lukmon, in Punch Newspaper, 2014)

The concept of forgery, counterfeiting, piracy, faking, alteration, fraud, corruption and bribery are some of the global crimes which have received serious attention from the international community, governmental and non-governmental organizations (Dakyes, 2006). Unfortunately, these menaces have not been well addressed, especially in the third world countries like Nigeria, where the problem is becoming endemic every day. Forgery and counterfeiting are said to be an aspect of fraud which has become almost a complete way of life for Nigerians at both home and abroad Ladan, (2008). Today in Nigeria, it is hard to see an original product without seeing it's counterfeit. Many Nigerians are seriously indicted for involvement in the menace. According to Bafarawa (2016), "Nigerian corruption starts from the grassroots, therefore 90 percent of Nigerians are corrupt". For example, a good number of politicians forging to win elections, civil servants counterfeiting to mismanage public funds, students faking to get admission or scholarship, lecturers forging for promotion, pharmacists fabricating substandard drugs, businessmen importing pirated products, contractors also scamming tax documents, manufacturers are producing substandard products while traders retailing counterfeited products and so forth.

Moreover, it is no more news that the 8th Nigerian senate standing order 2015 was speculated to have been forged by the senate leaders for their own selfish interest to win election to the Leadership of the house (Freedom Radio, 2015). Counterfeiting is being practiced all over the world for nefarious reasons, many different security printing techniques and materials have been used to protect valuable paper documents from forgery and counterfeiting. More recently, the present Minister of Finance, Mrs. Kemi Adeosun when she appeared before the Senate committee on finance to defend her 2016 budget, revealed that "over 23,000 ghost workers were exposed and most of them used forged or counterfeited paper documents to perpetrate this evil, this action alone helped the federal government of Nigeria to save over two billions Naira monthly". Moreover, President Muhammadu Buhari on the 29th of May, 2016 (Democracy Day) in his speech authenticated this fact by corroborating that "the number of federal government of Nigeria ghost workers has increased to 42,000, which has helped the federal government of Nigeria recover over four billions Naira monthly from ghost workers' salary" (Buhari, 2016 in Nigerian Television Authority). These menaces have brought great setback to national development. For this reason, there is need for serious and urgent efforts from graphic designers, researchers, indigenous ink producers, in-house paper mill companies and security printing industries to jointly tackle this ugly phenomenon for Nigeria to move forward.

1.2 Statement of the Problem

Authenticity is a virtue in any organization because it is the sign of sincerity, security, integrity, honor and morality. It is disturbing to know that an overwhelming number of Ahmadu Bello University's sensitive documents are counterfeited daily (A B U security unit, 2015).

Daily Trust Newspaper of Saturday, June 11th 2011, reported, that "a lecturer with Abubakar Tafawa Balewa University (ATBU), Bauchi, as well as Ibrahim Badamasi Babangida University, Lapai Niger state, Daniel Ishola Owaodemi, was found to be teaching for twelve years with fake Ahmadu Bello University, Zaria Certificate". (Olamiti, 2013) Similarly, Malam Tukur Mamu, the proprietor of the Desert Herald Newspaper, was accused of faking Ahmadu Bello University, Zaria's Master's Degree certificate. (Chukwumere, 2013).

Ibeh N. (2014) reported "a group of syndicate printers that specialize in counterfeiting valuable documents for a fee. West African Examinations Council (WAEC) and National Examinations Council (NECO) certificates cost N12, 000 only and can be provided in 30 minutes". In a society like Nigeria where emphasis is laid on paper qualification rather than capability, this makes nonsense of the need to spend six years in secondary school and four years in university for what could be obtained instantly. The counterfeits look so genuine that one wonders if the certificate does not actually come from the West African Examinations Council (WAEC) Office into the hands of counterfeiters. (Ibeh N. (2014). to mention but a few. This problem arises as results of overwhelming number of Ahmadu Bello University's sensitive documents are counterfeited daily (A B U security unit, 2015).

> *Organized crime facilitated by forgery and counterfeiting of valuable paper documents by fraudsters constitute a source of major societal problems in Nigeria with attendant consequences such as; damage to all facets of Nigeria's corporate existence, enormous loss of government revenue, undermining national development efforts, economic potential and political instability, erosion of efficiency and damage to national image (Dakyes, 2009).*

Therefore, the problem of the study is to investigate forgery methods and protective measures required with a view to adapting them on Ahmadu Bello University's sensitive documents for their protection against counterfeiting.

1.3 Aim and Objectives of the Study

The aim of this study is to adapt banknotes security features on Ahmadu Bello University's sensitive documents in order to protect them against counterfeiting.

In order to achieve the aim of this study the following objectives are set:

i. To study banknote security features for onward adaptation on Ahmadu Bello University's sensitive documents.

ii. Redesign some Ahmadu Bello University's sensitive documents by introducing multifarious security features on them.

iii. Carry out reliability test of the security features adapted on the Ahmadu Bello University's sensitive documents.

iv. Develop a body of knowledge in the area of security design, printing and paper document protection.

1.4 Research Questions

To conduct the investigation, the following research questions were raised:

i. How could the security features found on bank notes be adapted on Ahmadu Bello University's sensitive documents?

ii. How would Ahmadu Bello University's sensitive documents be redesigned by introducing multifarious security features on them?

iii. In what ways could reliability test be carried out on the adapted security features on Ahmadu Bello University's sensitive documents?

iv. How could a body of knowledge in the area of security printing and paper document protection be developed?

1.5 Scope of the Study

In order to achieve reliable results for this study, the extent of this research covers and focuses its attention on the banknote security features for the protection of valuable paper documents against forgery and counterfeiting.

1.6 Delimitation of the Study

In order to conduct a comprehensive investigation and come out with findings that will be generally accepted and have both external and internal validity, the study is delimited to the redesigning of some Ahmadu Bello University's sensitive documents by adapting banknote security features on them, which include the following.

i. Ahmadu Bello University's certificates

ii. Ahmadu Bello University's identity card

iii. Ahmadu Bello University's Admission letter

iv. Ahmadu Bello University's letterhead paper

v. Ahmadu Bello University's official receipt

1.7 Justification of the Study

There are several security features, materials and latest printing technologies on banknotes that can be adapted on Ahmadu Bello University's sensitive documents for protection against forgery and counterfeiting. In spite of the knowledge of these banknotes security features, methods and materials, only few have been adapted for paper document protection in Nigeria. Therefore, the justification for this study lies in the fact that presently the researcher is unaware of any research effort in the immediate past or in recent time carried out in order to address the long-term problems of forgery and counterfeiting of Ahmadu Bello University valuable paper documents. It is also in the opinion of the researcher that if no such study like this is directed at this time in this institution, the

problems will escalate beyond control. Moreover, this study will serve as a stimulus for our own indigenous security printing technologies, reducing unemployment, poverty, corruption, insecurity and enhance economic development. Buhari (2015) corroborate, this point," noting that oil will no longer sustain Nigeria", thus other sectors that could enhance the national economy need some attention.

1.8 Significance of the Study

i. This study constitutes a first step towards developing our own unique indigenous printing technology and opens it up for further research and development endeavours.

ii. This study serves as a channel to address the long-term problems of faking, and other related crimes in Ahmadu Bello University, Zaria, in particular, and Nigeria as a whole. Hence, Buhari (2015) notes the idea by saying "if Nigeria does not kill corruption, definitely corruption will kill Nigeria."

iii. The study will explore and create potential opportunities for indigenous ink producers, colour chemist, graphic designers, in-house paper mill companies as well as security printing industries in Nigeria.

iv. The study will contribute to the number of literature available for research purpose.

v. The research will advance the frontiers of knowledge in the area of currency design, security printing, security design, paper document protection, product protection, piracy, counterfeiting, forgery, fraud, faking and alteration. At the same time, the full implementation of the outcome of this research will serve as a starting point for not only Ahmadu Bello University, Zaria, but Nigeria as a whole to commence the design and printing of its own banknotes and other valuable paper documents by the use of indigenous security feature, ink, method and materials which will save billions of United State dollar spent on printing of sensitive paper documents outside the country.

CHAPTER TWO

REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

2.0 Introduction

This chapter reviews related literature that are of relevance, and also explores the intrinsic meaning of variables such as, bank-note, security feature, counterfeiting, forgery, document theft, cyber-crime, security printing, printing process, ink, and paper and so on. It is made up of the following areas: forgery and counterfeit, history of money, Forgery and Counterfeit, Paper Documents and Digital Forgery, Origin of paper money (Banknote), Banknote Design, security components Printing process, Ink, Paper and theory.

As of today in Nigeria, the scale of faking of valuable paper documents are not well documented, but it is common knowledge that there are enormous counterfeiting of valuable paper documents and products. Clark (1999) asserts that "the trend of counterfeiting and forgery in Nigeria has been on the increase, although it cannot be said precisely how much has been lost to counterfeiting". The World Health Organization, (2014) stressed that "over 10% of the global pharmaceutical products are counterfeited worldwide". Akunyili (2006) "over 7% of the world trades valued at about four trillions Naira are lost annually in the global market".

According to independent statistics from the World Customs Organization (2012), "the United States Government and the European Commission states that most of the world's counterfeit products are coming from China". Ojo and Ojo (2012) observed that "in the year 2000, China ranked fourth among the international sources of counterfeits and that 90 % of counterfeited goods seized in the United State in 2009 came from China". (W.C.O. 2012), further noted that "over two-third of counterfeit products seized at the European border in 2008 were produced in China". This stresses serious need for locally improvised material and

technology in our printing presses in order to address the menace of forgery and Counterfeiting in Nigeria

2.1 Forgery and Counterfeit

The words forgery and counterfeit are two different names that are so synonymous in usage and different in meaning. Forgery has to do with unlawful altering of genuine documents such as changing of name, grade, years, rank, gender, registration numbers, figures, passport and or signature of an original or genuine document with an intention to deceive someone. While counterfeit has to do with the complete production of fake documents or products to look indistinguishable from the original, with an intention to deceive the end users. According to National Document Fraud Unit United Kingdom (NDF UK, 2014), "forgery is a form of fraud that deals with the altering of products or valuable paper documents". Forged document is an original document that is unlawfully altered with intent to deceive, while counterfeit is the complete reproduction of fake version of an original document from scratch to resemble an officially issued document (NDF UK, 2014).

2.1.1 Pseudo document

Pseudo documents are documents that belong to nowhere and have no legal basis because they are not issued by a legally recognized person, organization or existing authority under the state or international law. In other word, pseudo documents are fake document without legal basis. National Document Fraud Unit United Kingdom (2015).

2.1.2 Camouflage documents

Camouflage documents are unauthorized documents that claim to come from a particular origin or country which does not even exist or have a new name for example someone with a visa issued by Biafra as a Nation or default Sokoto caliphate, or document signed by Head of glass technology department A B U Zaria. They are Camouflage

documents because the above mentioned organisations are not yet default or not in existence (NDF UK 2014).

2.2 Counterfeit and Forgery of the Ahmadu Bello University's Sensitive Documents

Ahmadu Bello University, Zaria is named after the first premier of Northern Nigeria, Sir Ahmadu Bello (1901-1966), the Sardauna of Sokoto, and the first Chancellor of the University. The official opening cceremony was performed on the 4th of October, 1962. The University was taken over by the Federal Government of Nigeria in 1975. The University has about 1,400 academic and research staff, and over 6000 non-teaching, senior and junior administrative staff. The University has also nurtured two University Colleges, the Abdullahi Bayero College (now Bayero University, Kano) and the Abubakar Tafawa Balewa College (now Abubakar Tafawa Balewa University of Technology, Bauchi) and 27 institutions made up of Colleges of Education and Polytechnics. (www.abu.edu.ng retrieved 15th June, 2014)

In Nigeria nowadays, it is hard to come across an original product without seeing it's counterfeit alongside (Akunyili, 2006). Daily Sun Newspaper, (2004) reports that in the year 2004, Transparency International, rated Nigeria as the third most corrupt nation in the world. Forgery and counterfeiting of Ahmadu Bello University's sensitive documents by fraudsters constitute a major source of institutional problems, resulting in undermining the nation's education, economic and political development. It could be claimed that no much success has been achieved in the area of security printing in Nigeria considering the terrible state of it today.

There are numerous cases of forgery and counterfeiting of Ahmadu Bello University's sensitive documents, which have been going on for decades without any serious action against the practice. Olamiti (2013), Head of the Media Unit of the Independent Corrupt Practices and Other Related Offenses Commission (ICPC), states that "another incident of fake Ahmadu Bello University's Certificate forgery of Mr. Iliya Philemon Hassan, a former

Director of Works at the Federal Polytechnic, Offa was accused of falsely claiming to have an Ahmadu Bello University, Zaria Master's Degree certificate as part of his curriculum vitae". Furthermore, the High Court in Ilorin, Kwara State, presided over by the Chief Judge of State, Justice J. Bamigbola, sent Hassan to jail on 25th June 2013 after he was found guilty on a three-count charge bordering on making false statement. The accused person had claimed in his Curriculum Vitae, submitted to the Registrar of the Federal Polytechnic, that he had a Master's Degree in Building Construction Technology from the Ahmadu Bello University, Zaria.

The problem of forgery and counterfeit of Ahmadu Bello University certificate are numerous: Reports clearly indicate that politicians too, are not left behind in the menace practice of forgery and counterfeit of sensitive documents, in order to contest for an elective post or to be employed. Today Newspaper of August 1-7, 1999 reported that "a house of Representatives Communications Committee, Chairman, Alhaji Abdulkadir Shehu Usman, used forged credentials for clearance to contest elections into the House of Representatives. Investigations into documents submitted to INEC by Alhaji Abdulkadir Shehu have shown that both his secondary school leaving testimonial and the statement of result from the Ahmadu Bello University, Zaria". Therefore, the problem of the study is to investigate forgery methods and protective measures with a view to adapting them on Ahmadu Bello University's sensitive documents for their protection against counterfeiting.

2.3 Online Forgery

Easy availability and accessibility to internet services make Nigerians thinks their sensitive paper documents are more save digitally, this is not true (Adeta, 2014). Hassan (on channels TV 2015 states that Nigeria is ranked as the 1st most cyber-crime nation in Africa and 3rd most cybercrime nation in the world. The office of the Nigeria National security

Adviser (2014) identified top five cyber cases in Nigerian, which include cybercrime, cyber espionage, cyber conflict, cyber terrorism and child online abuse.

Easy accessibility to digital editing software makes the activities of document theft easy and rampant. Digital forgery can be done in various ways with simple operations tools like colour, brightness, contrast adjustments, blurring, filtering and compression and noise addition. The Central Bank of Nigeria (CBN) revealed that the Nigeria's banking sector lost N 7.2 billion Naira to internet fraud (in Adeta 2014). Furthermore, Math and Tripathi (2010) in Adeta (2014). Notes that "recent advances in software development, plug and play tools to capture, process, access and transmit digitized data makes it so easy to alter the information without leaving any visual clues of tempering".

Additionally, the Economic and Financial Crime Commissions (EFCC, 2014) states "that Nigeria lost about N 7.33 billion in 2007 alone, as well as N 641 billion in 2013 to the cyber-crime and it is at risk of losing over 15 billion USD by 2020. This is a clear indication that it's very paramount for any serious organizations to urgently secure their sensitive paper document locally against counterfeiters".

The first documented cybercrime was reported in France around year 1820 by J.M. Jacquard, a textile manufacturer. Jacquard created a loom device, this device allowed the repetition of a series of steps in the weaving of special fabrics. Went Jacquard's staff noted this development, and their fear of massive sack resulted in the perpetuation of the acts of sabotage to discourage Jacquard from further use of the new technology. This was the first recorded cybercrime in the world (Planetindia, 2001 in Adeta 2014).

(Ophardt 2014 in Adeta, 2014). opined that, "cyber-crimes differ from most terrestrial crimes in four ways namely":

a) They are easy to learn how to commit.

b) They require few resources relative to the potential damage caused.

c) They can be committed in a jurisdiction without being physically present.

d) They are often not clearly illegal.

Today in Nigeria, life has been digitalized technology has become predominant in our daily lives. Hence creating, processing, transmitting and storing of sensitive and non-sensitive documents as facts, evidence, information, knowledge and intellectual assets in government and nongovernmental organisations are very crucial (Adeta, 2014).

Young Media Association (2007) lists the following advantages of internet services to the Nigerian economy as follows:

a. facilitation of job search and employment

b. accessibility to research information for education and businesses

c. rural integration

d. enhancement of trade and commerce

e. sharing of resources and ideas, and

f. enhanced communication

Considering these enormous advantages of internet, one can easily subscribe to the fact that it is an important tool for national development in a developing country like Nigeria (Adeta, 2014). In spite of the fact that technology serves as a means of national development, it has brought about a new wave of crime which is a threat to the educational, economic, political, security and the development of Nigeria as a country. Salihu (2007) notes that the convergence of computing and communication have brought immense benefits to the society, but these benefits also come with greater risk both nationally and internationally.

This form of crime is commonly referred to as cyber-crime or ‘‘yahoo-yahoo’’, which is the latest and perhaps the most complicated problem in the cyber world today. It covers a wide range of illegal activities on the cyber space. Cybercrime simply means the use of computers and internet as a tool to conduct illegal activity such as forgery, financial fraud,

identity theft, publishing and copyright violations amongst others (Adeta 2014). This new crime is denting and drilling holes in the economy of the nation. For example, in a recent report by the Internet Crime Complaint Centre which is a partnership between the FBI and America's National White Collar Crime Centre, revealed that Nigeria now ranked third among the list of top ten sources of cybercrime in the world (Abdulhamid, Haruna, Abubakar 2011). Apart from the destruction cyber-crime does to the economy, it also leads to the erosion of confidence in genuine Nigerian social, educational and commercial credibility. Today, many western countries with France taking the lead have moved to deny Nigerian's legitimate businessmen and women the rewards of e-commerce. France today requires web camera verification for most online businesses.

2.4 Origin of Paper Money (Banknote)

Understanding the history of Banknote is very significant to this study, the first paper-like money was printed on white Deer skin (leather) around 120 BC in China. The white Deer are those animals that can only be found in the imperial Chinese gardens (World Record Academy, 2015).

There are divergent views about the origin of money, According to Heij H. (2012), the early civilisation exchanged commodity with commodity or goods and services without using any form of money which known as trade by barter (De Heij (2006). Later the use of cowries as primitive money eventually spread. De Heij H.A.M (2000) stated that cowries were the original money circulated around 2000 BC in China and later also spread to India, Thailand as well as Africa. The Cowries world-wide popularity had two reasons first their uniform shape and size makes it easy to transport and count.



Figure 1: Cowries

Retrieved www.primitivemoney.com (2015)

Secondly, around 14th century, the used of Cod as a means of payment was widespread in the trade between England and Iceland, for instance the price of 48 yards of textile was 120 pieces of Cod. (History of money, 2015) Other means of payment was the use of commodities, like livestock (sheep, goat, and cow).

Thirdly, Copper-based serves as another form of money at the transitional stage between original money and metal Katanga cross used in south-east Congo in the early 16th century. (De Heij H. (2006). A single Shaba Cross would buy some 10 kilos of local manioc flour or 5 chickens. A cross was moulded in dry sand and filled with native copper, each cross weighing approximately 0.6 kilogram and measuring about 0.2 metres. (History of Money, 2015).

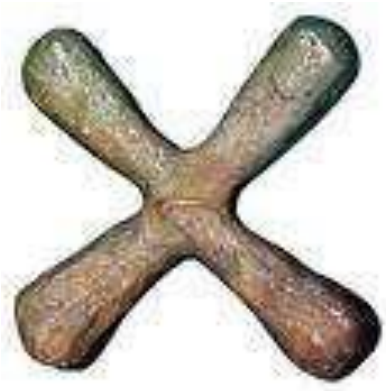


Figure 2: Katanga Cross
Source: - www.primitivemoney.com (2015)

After the use of Copper-based (Katanga cross) the use of tea bricks emerged in Asia. World Record Academy (2015) asserts that Tea bricks were used as a form of money throughout East and Central Asia up until the mid-20th century. The bricks were produced by mixing tea and blood. They were available in different qualities, which were valued accordingly.



Figure 3: Tea Bricks

Source: - www.primitivemoney.com (2015)

2.4.1 Coins Money

The story of coin money started around 600 BC in present day western Turkey (De Heij H. (2012). states that Lydia was a kingdom in Turkey where Electrum coins were made between 600BC to 550BC. The first coins were minted in Lydia; initially in electrum, later in

gold and silver, the lion head symbolizes the King of Lydia. Lydian gold coin was issued under the reign of King Croesus (561-547 BC). (Heij H. 2012)



Figure 4: Lydian silver coin around 550 BC
Source: - www. Lydiansilvercoin.com (2015)

2.4.2 First portrait on Coins

Alexander the Great (356-323BC) was the first image ever to appear on coin money. (World record academic, 2014) after Alexander died, coins were issued showing idealized portraits.



Figure 5: Alexander the Great 325 BC
Source: - World record academic, (2014)

Secondly, the first royal whose image when he was alive appeared on coin was that of Greco Bactria Antimachus I185-170 BC (History of Money, 2015).



Figure 6: Greco Bactria Antimachus I185-170 BC.

Source: - World record academic, (2014)

2.4.3 First Paper Money Banknote (Running Cash)

The first paper money (lettera di cambio) or (running cash) emerged around 120 BC, when silver and gold coins were still used for daily payments in Europe (Heij H. 2012).

The earliest real paper money emerged in the 7th century as a result of shortage of coins in China, which led to the issuing of paper money by the Chinese authority as a result of economic development, as well as the counting, transportation and storage of metal coins which became increasingly awkward. In an effort to overcome these problems, some money-changers initiated coins store at their safe offices and started issuing a formal document (Banknote) to merchant whose keeps coins in their store, thus merchant could transfer the Paper document (Banknote) to a third party, who had to sign the document subsequently. These formal documents, i.e. the first forms of paper money, were called ‘lettera di cambio’, where and in England ‘running cash notes. De Heij H.A.M (2000)



Figure 7: **Issued by Stockholms Banco The first private banknotes in Europe, a 10 taller banknote, dated 18 May 166**
Source: -www. historyofmoney 2015.com



Figure 8: **Chinese banknote of 1,000 cash, issued in 1375 by the Chinese Ming emperor Hong Wu (1368-1398).**
Source: -www. historyofmoney 2015.com

A Chinese banknote of 1,000 cash, issued in 1375 by the Chinese Ming emperor Hong Wu (1368-1398). The paper made of bark of the paper mulberry tree (Broussonetia papyrifera), measures 340 mm x 225 mm, larger than an A4 size paper. (www.historyofmoney.com 2015)

2.4.4 Card money

Card money was another form of money used in Canada. Heij H. (2012) states that Coins in the colony of New France in Canada had to come in by ship from France. Before these shipments arrived in a desperate move to keep day-to-day commerce running, the government card money was introduced by France government with a written promise to pay what was owed before the next shipment of coins would arrive. (History of Money, 2015)

2.4.5 Pay to Bearer (Betaalt aan toonder)

Pay to bearer can be described as the second generation of paper money. This is a form of agreement between two parsons known as 'promised to pay to the bearer' this form of money carries a short text of just three words; ('will pay to bearer'). (History of money 2015).



Figure 9: Pay to bearer
Netherlands, 1847
Source:-www. historyofmoney 2015.com

2.4.6 19th Century's Banknotes

The 19th century banknotes are characterized by printing of different types of money within the same regime without control. Heij H. (2012) states that around 1810 there were hundreds of bank operating in Britain and issuing different Banknotes without regulatory body. Banknotes were not yet a state monopoly and to start a bank was a profitable enterprise; every goldsmith, bank or other private organisation could issue banknotes, resulting in many different forms of domestically issued paper currencies. This action made illiterate people to have difficulty in differentiating between real and fake banknotes.

The first bank monetary union was created in 1789 by the United States (De Heij, 2006)

De Heij H.A.M (2000). Notes that this monetary union lasted until 1792 when the United States became one political entity, one nation. Two attempts to establish a central bank failed, with the result that many banks issued their own banknotes without any oversight. It is estimated that at the end of the 19th century there were around 8,000 institutions, issuing over 5,000 different banknotes in United States. Legal restrictions against private currencies followed and in 1913 a system of central banks were established named 'Board of Governors of the Federal Reserve System of Central Banks in the USA' On the notes was written 'Federal Reserve Note'; the 'Federal Reserve System' is often shortened to 'Federal Reserve. (History of money 2015).



Figure 10: The 19th Century's banknotes. This banknote bears the text, 'Received from bearer the amount of FORTY guilders to be returned to bearer upon presentation'

TheNetherlands1847. This banknote bears the text, 'Received from bearer the amount of FORTY guilders to be returned to bearer upon presentation' (in Dutch: Ontvangen van toonder de somma van VEERTIG guldens om aan toonder op vertooning te restituëren.'). Source: - www. Netherlands1847.com (2015)



Figure 11: The 19th Century's banknote of the British Linen Company, issued in Edinburgh on 1 June 1868

Banknote of British Linen Company, issued in Edinburgh on 1 June 1868. This banknote bears the printed text, 'Promise to pay on demand to Mr. William Spence or bearer one hundred pounds sterling. (De Heij H.A.M 2000)



Figure 12: The 19th Century's Banknotes

Banknote of the Merchants Bank of Halifax, 1880. In the centre: ship under sail.

Source: - www. Netherlands1847.com (2015)



Figure 13: The 19th Century's Banknotes

Continental banknote of 5 dollar, issued by the Congress in 1775. Transcription of the text: 'This Bill entitles the Bearer to receive FIVE SPANISH MILLED DOLLARS, or the Value thereof in GOLD or SILVER according to a Resolution of CONGRESS Passed at PHILADELPHIA, November 29, 1775'.

Source: - www. Netherlands1847.com (2015)

2.4.7 The Emergence of Portraiture on Banknotes (1920-1995)

The first human portraiture appeared on banknote was in Netherlands in 1921 (De Heij 2006)

The banknote designers include portraits, with the intent of reinforcing public trust in the economy.



Figure 14: The 1926 Netherlands, 1926
Source: - www. Netherlandsbanknote.com (2015)

A new era began for portrait on banknote designs emerged after the Second World War was over. The main idea for using portraitures on banknotes was to create a confidence in a piece of paper that supported with a portrait of person whom people trusted (De Heij, 2012).



Figure 15: French FFR 100 Banknote, Issued in 1939

French FFR 100 banknote, issued in 1939. A fine example of combining a main image (unknown lady) and security feature (watermark)
Source: - www. Netherlandsbanknote.com (2015)

2.4.8 Non Portraiture Banknotes

The Islamic culture differs from the Western world in several ways, including banknote design. For a long time, coins and banknotes used in Islamic civilizations did not have portraits for religious and cultural reasons until recently one can notice a small portion of portraiture in some of their banknotes (De Heij H. (2006).



Figure 16: Egyptian pound, EGP 200 (2007).

Source: - www.egyptianbanknote.com (2015).



Figure 17: Egyptian Pound, EGP 200 (2007)

Source: Sudanese pound, SDP 10 (2005).



Figure 18: Tunisian dinar, TND 10

Source: - Tunisian dinar, TND 10 (2005).



Figure 19: Tunisian Diner, TND 10

Source: -Saudi riyal, SAR 50 (2007)

2.4.9 The Movement to Abandon Portraits

Apart from Islamic countries, non-Muslim countries, too, abandon the use of portraiture on their banknotes for different reasons. In case of the Euro notes, it was not possible to find a series of portraits without a bias to one of the members of the European Union. According to De Heij H.A.M (2000) Central Banks want to abandon the use of portraiture in the banknote, since it is no longer seen as appropriate for the present day spirit.



Figure 20: Euro, EUR 100 (2002). Arch in baroque and rococo style
Euro, EUR 100 (2002). Arch in baroque and rococo style.
Source:-www. historyofmoney 2015.com



Figure 21: Netherlands gulden, NLG 100 (1981)

Netherlands gulden, NLG 100 (1981). Bird, a snipe.
Source: - www. Netherlandsbanknote.com (2015)



Plate 22: South African rand, ZAF 10 (1993). Rhinoceros

Source:-www. historyofmoney 2015.com



Figure 23: Danish krone, DKK 50 (2009). Bridge, Sallingsund Bridge

Danish krone, DKK 50 (2009). Bridge, Sallingsund Bridge.
Source:-www. historyofmoney 2015.com



Figure 24: Flag of Sierra Leone on SLL 10,000, 2004

Source:-www. historyofmoney 2015.com



Figure 25: Flag of Sierra Leone on SLL 10,000, 2004

Source: - South African rand, SAR 100 (2005).

In contrast, the central banks, of Israel and Sweden, started, in 2011, the development of a new series of banknotes and both decided it would be (again) a portrait series. Both central banks did not explain why, but focussed on the lists of persons to be portrayed.

2.4.10 Synthetic (Polymer) Banknotes

The first full plastic banknote was issued in Haiti, in 1974, and printed on 'Tyvek',. (Tyvek is a spun-bonded Dupont product, commonly used for tear-resistant mailers and house wrap. The first successfully introduced synthetic banknote was issued in 1988, by the Central Reserve Bank of Australia. Polymer banknotes seem to have three advantages over banknotes printed on cotton paper. De Heij H.A.M (2000)



Figure 26: Fifty Naira

Source: polyd * ssmernotes.com (2014)



Figure 27: Polymer Banknotes

Source: polymernotes.com (2014)



Figure 28: Polymer Banknotes

Source: polymernotes.com (2014)

Table 4.1: The World Banknotes and the Name of their Banks

AFGHANISTAN	**AFN**	Afghani	Da Afghanistan Bank
ALBANIA	**ALL**	Lek	Bank of Albania
ALGERIA	**DZD**	Algerian dinar	Banque d'Algérie
AMERICAN SAMOA	**USD**	US dollar	The Federal Reserve Board
ANDORRA	**EUR**	Euro	Eurpean Central Bank
ANGOLA	**AOA**	Kwanza	Banco Nacional de Angola
ANGUILLA	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank
ANTIGUA & BARBUDA	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank
ARGENTINA	**ARS**	Argentinian peso	Banco Central de la Republica Argentina
ARMENIA	**AMD**	Armenian dram	Central Bank of Armenia
ARUBA	**AWG**	Aruban Guilder	Central Bank of Aruba
AUSTRALIA	**AUD**	Australian dollar	Reserve Bank of Australia
AUSTRIA	**EUR**	Euro	Österreichische Nationalbank
AZERBAIJAN	**AZM**	Manat	National Bank of Azerbaijan
BAHAMAS	**BSD**	Bahamian dollar	The Central Bank of The Bahamas
BAHRAIN	**BHD**	Bahraini dinar	Bahrain Monetary Agency
BANGLADESH	**BDT**	Taka	Central Bank of Bangladesh
BARBADOS	**BBD**	Barbados dollar	Central Bank of Barbados
BELARUS	**BYR**	Belarussian rouble	National Bank of the Republic of Belarus
BELGIUM	**EUR**	Euro	Banque Nationale de Belgique
BELIZE	**BZD**	Belize dollar	Central Bank of Belize
BENIN	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
BERMUDA	**BMD**	Bermuda dollar	Bermuda Monetary Authority
BHUTAN	**BTN**	Ngultrum	
BOLIVIA	**BOB**	Boliviano	Banco Central de Bolivia
BOSNIA-HERZEGOVINA	**BAM**	Convertible Marks	Central Bank of Bosnia & Herzegovina
BOTSWANA	**BWP**	Pula	Bank of Botswana
BRAZIL	**BRL**	Real	Banco Central do Basil
BRUNEI DARUSSALAM	**BND**	Brunei dollar	The Government of Brunei Darussalam

BULGARIA	**BGN**	Lev	Bulgarian National Bank
BURKINA FASO	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
BURUNDI	**BIF**	Burundi franc	Banque de la République du Burundi
CAMBODIA	**KHR**	Riel	National Bank of Cambodia
CAMEROON	**XAF**	CFA Franc - BEAC	Banque des Etats de l'Afrique Centrale
CANADA	**CAD**	Canadian dollar	Bank of Canada
CAPE VERDE	**CVE**	Cape Verde escudo	Banco de Cabo Verde
CAYMAN ISLANDS	**KYD**	Cayman Islands dollar	Cayman Islands Monetary Authority
CENTRAL AFRICAN (REP.)	**XAF**	CFA Franc - BEAC	Banques des Etats de l'Afrique Centrale
CHAD	**XAF**	CFA Franc - BEAC	Banque des Etats de l'Afrique Centrale
CHILE	**CLP**	Chilean peso	Banco Central de Chile
CHINA	**CNY**	Ren-Min-Bi yuan	People's Bank of China
COLOMBIA	**COP**	Colombian peso	Banco de la Republica
COMOROS	**KMF**	Comoro franc	Banque Centrale des Comores
CONGO	**XAF**	CFA Franc - BEAC	Banques des Etats de l'Afrique Centrale
CONGO, (REP. DE.)	**CDF**	Franc congolais	Banque Centrale du Congo
COSTA RICA	**CRC**	Costa Rican colon	Banco Central de Costa Rica
COTE D'IVOIRE	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
CROATIA	**HRK**	Kuna	Croatian National Bank
CUBA	**CUP**	Cuban peso	Banco Central de Cuba
CYPRUS	**CYP**	Cyprus pound	Central Bank of Cyprus
CZECH REPUBLIC	**CZK**	Czech koruna	Ceska Narodni Banka
DENMARK	**DKK**	Danish krone	Danmarks Nationalbank
DJIOUTI	**DJF**	Djibouti franc	Banque Centrale de Djibouti
DOMINICA	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank
DOMINICAN REP.	**DOP**	Dominican peso	Banco Central de la Republica Dominicana
ECUADOR	**USD**	US dollar	Banco Central del Ecuador
EGYPT	**EGP**	Egyptian pound	Central Bank of Egypt
EL SALVADOR	**SVC**	El Salvador colon	Banco Central de Reserva de El Salvador
EQUATORIAL	**XAF**	CFA Franc - BEAC	Banques des Etats de l'Afrique

GUINEA			Centrale
ERITREA	**ERN**	Nakfa	Central Bank of Eritrea
ESTONIA	**EEK**	Estonian kroon	Eesti Pank
ETHIOPIA	**ETB**	Ethiopian birr	National Bank of Ethiopia
FIJI	**FJD**	Fiji dollar	Reserve Bank of Fiji
FINLAND	**EUR**	Euro	Suomen Pankki
FORMER YUGOSLAV REP. OF MACEDONIA	**MKD**	Denar	Narodna Banka na Republika Makedonija
FRANCE	**EUR**	Euro	Banque de France
GABON	**XAF**	CFA Franc - BEAC	Banques des Etats de l'Afrique Centrale
GAMBIA	**GMD**	Dalasi	Central Bank of the Gambia
GEORGIA	**GEL**	Lari	National Bank of Georgia
GERMANY	**EUR**	Euro	Deutsche Bundesbank
GHANA	**GHC**	Cedi	Bank of Ghana
GIBRALTAR	**GIP**	Gibraltar pound	Treasury Department of the Government of Gibraltar
GREECE	**EUR**	Euro	Bank of Greece
GRENADA	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank
GUATEMALA	**GTQ**	Quetzal	Banco de Guatemala
GUINEA	**GNF**	Guinean franc	Banque Central de la République de Guinée
GUINEA BISSAU	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
GUYANA	**GYD**	Guyana dollar	Bank of Guyana
HAITI	**HTG**	Haitian gourde	Banque de la République d'Haiti
HONDURAS	**HNL**	Lempira	Banco Central de Honduras
HONG KONG	**HKD**	Hong Kong dollar	Hong Kong Monetary Authority
HUNGARY	**HUF**	Forint	Magyar Nemzeti Bank
ICELAND	**ISK**	Icelandic Krona	Central Bank of Iceland
INDIA	**INR**	Indian rupee	Reserve Bank of India
INDONESIA	**IDR**	Rupiah	Bank Indonesia
IRAN	**IRR**	Iranian rial	Central Bank of the Islamic Republic of Iran
IRAQ	**IQD**	Iraqi dinar	Central Bank of Iraq
IRELAND	**EUR**	Euro	Banc Ceannais na Heireann
ISRAEL	**ILS**	New Israeli sheqel	Bank of Israel
ITALY	**EUR**	Euro	Banca d'Italia

JAMAICA	**JMD**	Jamaican dollar	Bank of Jamaica
JAPAN	**JPY**	Yen	Nippon Ginko
JORDAN	**JOD**	Jordanian dinar	Central Bank of Jordan
KAZAKHSTAN	**KZT**	Tenge	Kazakstan Ulttyk Banki
KENYA	**KES**	Kenyan shilling	Banki Kuu Ya Kenya
KOREA (REP.)	**KRW**	Won	The Bank of Korea
KUWAIT	**KWD**	Kuwaiti dinar	Central Bank of Kuwait
KYRGYZSTAN	**KGS**	Som	National Bank of the Kyrgyz Republic
LAOS (PEO. DEM. REP.)	**LAK**	Kip	Central Bank of the Lao People's Democratric Republic
LATVIA	**LVL**	Latvian lats	Latvijas Banka
LEBANON	**LBP**	Lebanese pound	Banque du Liban
LESOTHO	**LSL**	Loti	Central Bank of Lesotho
LIBERIA	**LRD**	Liberian dollar	Central Bank of Liberia
LIBYA (ARAB JAMAHIRIYA)	**LYD**	Libyan dinar	Central Bank of Libya
LIECHTENSTEIN	**CHF**	Swiss franc	Financial Market Authority
LITHUANIA	**LTL**	Lithuanian litus	Lietuvos Bankas
LUXEMBOURG	**EUR**	Euro	Banque Centrale du Luxembourg
MACAO	**MOP**	Pataca	Monetary Authority of Macao
MADAGASCAR	**MGA**	Malagasy Ariary	Banky Foiben'i Madagasikara
MALAWI	**MWK**	Kwacha	Reserve Bank of Malawi
MALAYSIA	**MYR**	Malaysian ringgit	Bank Negara Malaysia
MALDIVES	**MVR**	Rufiyaa	Maldives Monetary Authority
MALI	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
MALTA	**MTL**	Maltese pound	Bank Centrali ta' Malta
MARSHALL ISLANDS	**USD**	U.S. dollar	The Federal Reserve Board
MAURITANIA	**MRO**	Ouguiya	Banque Centrale de Mauritanie
MAURITIUS	**MUR**	Mauritian rupee	Bank of Mauritius
MEXICO	**MXN**	Mexican peso	Banco de Mexico
MOLDOVA (REP. OF)	**MDL**	Moldovan leu	Banca Nationala a Moldovei
MONACO	**EUR**	Euro	Banque de France
MONGOLIA	**MNT**	Tugrik	Mongol Bank
MONTSERRAT	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank

MOROCCO	**MAD**	Moroccan dirham	Bank Al-Maghrib
MOZAMBIQUE	**MZM**	Metical	Banco de Moçambique
MYANMAR	**MMK**	Kyat	Central Bank of Myanmar
NAMIBIA	**NAD**	Namibian dollar	Bank of Namibia
NAURU	**AUD**	Australian dollar	Bank of Nauru
NEPAL	**NPR**	Nepalese rupee	Nepal Rastra Bank
NETHERLANDS ANTILLES	**ANG**	Netherlands Antillean Guilder	Bank van de Nederlandse Antillen
NEW ZEALAND	**NZD**	New Zealand dollar	Reserve Bank of New Zealand
NICARAGUA	**NIO**	Cordoba Oro	Banco Central de Nicaragua
NIGER	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
NIGERIA	**NGN**	Naira	Central Bank of Nigeria
NORWAY	**NOK**	Norwegian krone	Norges Bank
OMAN	**OMR**	Omani rial	Central Bank of Oman
PAKISTAN	**PKR**	Pakistani rupee	State Bank of Pakistan
PANAMA	**PAB**	Balboa	Banco Nacional de Panama
PAPUA NEW GUINEA	**PGK**	Kina	Bank of Papua New Guinea
PARAGUAY	**PYG**	Guarani	Banco Central del Paraguay
PERU	**PEN**	Nuevo Sol	Banco Central de Reserva del Peru
PHILIPPINES	**PHP**	Philippine peso	Bangko Sentral Ng Pilipinas
POLAND	**PLN**	Zloty	Narodowy Bank Polski
PORTUGAL	**EUR**	Euro	Banco de Portugal
PUERTO RICO	**USD**	US dollar	The Federal Reserve Board
QATAR	**QAR**	Qatari riyal	Qatar Central Bank
ROMANIA	**ROL**	Leu	National Bank of Romania
RUSSIAN FEDERATION	**RUB**	Russian rouble	Bank Rossiyi
RWANDA	**RWF**	Rwanda franc	Banque Nationale du Rwanda
SAINT KITTS AND NEVIS	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank
SAINT LUCIA	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank
SAINT VINCENT AND THE GRENADINES	**XCD**	Eastern Caribbean dollar	Eastern Caribbean Central Bank
SAO TOME AND PRINCIPE	**STD**	Dobra	Banco Central de Sao Tomé e Pincipe
SAUDI ARABIA	**SAR**	Saudi riyal	Saudi Arabian Monetary Agency

SENEGAL	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
SERBIA AND MONTENEGRO	**CSD**	Serbian Dinar	Narodna Banka Srbije
SEYCHELLES	**SCR**	Seychelles rupee	Central Bank of Seychelles
SIERRA LEONE	**SLL**	Leone	Bank of Sierra Leone
SINGAPORE	**SGD**	Singapore dollar	Monetary Authority of Singapore
SLOVAKIA	**SKK**	Slovak koruna	Narodna Banka Slovenska
SLOVENIA	**SIT**	Tolar	Banka Slovenije
SOMALIA	**SOS**	Somali shilling	Central Bank of Somalia
SOUTH AFRICA	**ZAR**	Rand	South African Reserve Bank
SPAIN	**EUR**	Euro	Banco de España
SRI LANKA	**LKR**	Sri Lankan rupee	Central Bank of Sri Lanka
SUDAN	**SDD**	Sudanese dinar	Bank of Sudan
SURINAME	**SRD**	Surinam dollar	Central Bank van Suriname
SWAZILAND	**SZL**	Lilangeni	Central Bank of Swaziland
SWEDEN	**SEK**	Swedish Krona	Sveriges Riksbank
SWITZERLAND	**CHF**	Swiss franc	Schweizerische Nationalbank
SYRIA (ARAB REP.)	**SYP**	Syrian pound	Central Bank of Syria
TAJIKISTAN	**TJS**	Somoni	National Bank of Tajiskistan
TANZANIA (UNITED REP. OF)	**TZS**	Tanzanian shilling	Benki Kuu Ya Tanzania
THAILAND	**THB**	Baht	Bank of Thailand
THE NETHERLANDS	**EUR**	Euro	De Nederlandsche Bank
TIMOR - LESTE	**USD**	US dollar	The Federal Reserve Board
TOGO	**XOF**	CFA franc - BCEAO	Banque Centrale des Etats de l'Afrique de l'ouest
TONGA	**TOP**	Pa'anga	National Reserve Bank of Tonga
TRINIDAD AND TOBAGO	**TTD**	Trinidad and Tobago dollar	Central Bank of Trinidad & Tobago
TUNISIA	**TND**	Tunisian dinar	Banque Centrale de Tunisie
TURKEY	**TRL / TRY**	Turkish Lira	Turkiye Cumhuriyet Merkez Bankasi
TURKMENISTAN	**TMM**	Manat	Central Bank of Turkmenistan
TURKS AND CAICOS ISLANDS	**USD**	US dollar	The Federal Reserve Board
UGANDA	**UGX**	Ugandan shilling	Bank of Uganda
UKRAINE	**UAH**	Hryvnia	National Bank of Ukraine

UNITED ARAB EMIRATES	**AED**	UAE dirham	Central Bank of the United Arab Emirates
UNITED KINGDOM	**GBP**	Pound sterling	Bank of England
UNITED STATES	**USD**	U.S. dollar	The Federal Reserve Board
URUGUAY	**UYU**	Uruguayo peso	Banxo Central del Uruguay
UZBEKISTAN	**UZS**	Uzbekistan sum	Central Bank of Uzbekistan
VENEZUELA	**VEB**	Bolívar	Banco Central de Venezuela
VIET NAM	**VND**	Dong	State Bank of Viet-Nam
VIRGIN ISLANDS (BRITISH)	**USD**	U.S. dollar	The Federal Reserve Board
YEMEN (REP.)	**YER**	Yemeni rial	Central Bank of Yemen
ZAMBIA	**ZMK**	Kwacha	Bank of Zambia
ZIMBABWE	**ZWD**	Zimbabwean dollar	Reserve Bank of Zimbabwe

Source:- International Monetary Bank (2015)

2.5 Banknote Design

Banknote design requires very specific technical knowledge in a range of areas, such as aesthetics, printing techniques, security features, color interactions, wording and sizes of each denomination based on public surveys and expert advice Dakyes (2006).

Once these features are agreed upon, the designer produces a picture of the front and back of each denomination. These pictures are produced in the correct size and colors with the aid of a computer-based design system (Kim, E. and T. Turton 2014)

These banknote designs are assessed by different people, including security printers, security experts, banker, graphic designers, historians and cultural specialists Giesecke and Devrient (2008)

2.5.1 Security Components of Banknote

Banknotes remain the most protected paper document all over the world, due to the fact that it is the most highly sensitive paper documents to be counterfeited. Dakyes (2009) noted that, there are so many paper security components, but they can be classified into four

basic areas: Ink, paper, design and printing process. Giesecke and Devrient (2008) points that "security printing requires a high degree of specialization, and innovative in-house technologies for all its security printing solutions from ink and paper to printing processes, security features, and authentication procedures"

The following are some of the banknote security features (Kim, E. and T. Turton 2014)

i. **Paper quality**- This type of paper that we use in our daily lives, it is totally different from the banknote security paper, in printing banknote special paper are used in order to make it more complicated to counterfeits and gives it a longer life.

ii. **Security thread**- Security threads are the most common security features on banknote which are remarkably hard to be made without the help of special tool or equipment. These threads are embedded into the paper at very early stage of banknote paper making process. Usually there are two types of security threads: internal security thread and diving security thread. The internal security threads are completely seeing within the sheet of the paper and these threads may be solid and transparent, comprising some micro-text for example CBN, ABU Zaria and so forth. Secondly, Plastics and metal can be used as a security threads.

iii. **Gradient colouring**- This is one of the most reliable security feature which is very difficult to recreate even with best duplicating devices. Banknotes are printed with - colour gradients that change to deter counterfeits, this is because the commercially available scanners would not be able to capture out the variations in colour.

iv. **Ultra Valence glowing**- It is one the most newly added security feature that can be found on the modern banknotes. In this techniques, the particular image or texts in the banknotes glow when they exposed to UV rays.

v. **Micro texts-** micro texts are minor texts which cannot be seen by naked eyes. These are hidden in any part of a banknote like near portraits, numbers, and other. in order to prevent faking.

vi. **Holograms-** Holograms are one of the most recent banknote security features. It's very difficult to reproduced technically innovative equipment. They are ingrained via a special technique like hot-stamping foil and so on.

vii. **Anti-copying mark-** This feature was incorporated on banknotes as a security feature in late twentieth century. These are special types of lines and decorations incorporated in banknote with the help of special software and hardware that makes it difficult to be reproduces.

viii. **Watermarks-** watermark is the most well-known security feature of paper banknote. A watermark is basically any type of image or pattern that appears when the paper is exposed to any light source. It incorporated during the paper making process by using water coated metal stamp.

ix. **IR glowing-** It is one of the newly introduced security feature in banknotes. Currently only two countries are using this feature in their currency that is Euro and Russian note. It is similar like UV glowing.

x. **Colour changing**- This is another newly introduced security features on modern banknotes. It gives special effect, in which when the imprint is viewed from different angles its colour changes. And when the imprint is viewed under microscope it shows a raised polygonal object whose topmost side is of one colour and other sides have different type of colour.

xi. **Denomination marks-** It is the most commonly used security feature. It is large size numerical written several times in different locations of a banknote. Now a day's to

prevent counterfeiting, the denomination marks are repeated in several ways like in backgrounds, micro texts, etc.

xii. **Numbers-** numbers written on banknote have relation with the security features. Numbers present on the banknotes are unique because every banknote has its unique number and they never repeat.

xiii. **Complicated portraits-** This feature is most difficult to copy because of the presence of fine details in a portrait. Currently most of the currencies in the world possess portraits.

xiv. **Background decorations-** The background decorations are well arranges beautiful complicated design and also very hard to copy because they are made by putting several layers on one another.

xv. **Mark for blind-** Every currency in world consists of different type and different shapes of mark. These marks help in identification of particular type of banknote for blind people by using their fingers.

Intaglio printing- This is a special technique of printing that creates unique security features on modern banknotes. Intaglio means 'raised'. In this technique the image is carved into the surface. It is designed by putting about 60 layers of colour on the same position on the banknote, because of this layering the letter or image gains volume and thus you can feel it by touching it with the fingers. (Faiola, 1999).

xvi.

2.5.2 Banknote Design Software

The following are some of the latest banknote design software (GuardSoft 2015)

1. CERBERUS

Cerberus: This is a banknote design software that allows you to create complicated and yet controllable guilloche lines, as well as decorative and protective guilloche elements, to

generate various backgrounds, rosettes, borders, and other guilloche elements with the specified numeric parameters.

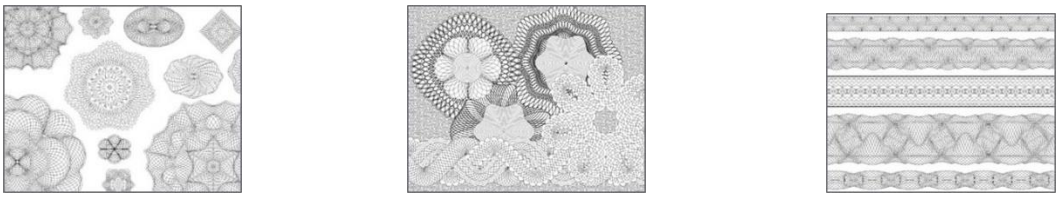


Figure 29: Banknote guilloche lines
Retrieved from GuardSoft 2015 Faiola, (1999).

Users create elements in real-time mode, and guilloche elements are specified geometrically and are controlled by a number of parameters. This considerably speeds up the process, simplifies further modification and saves the time of the designer. The results are exported to PostScript file and can be used by any vector editor or make-up program (Adobe Illustrator, Macromedia FreeHand, Corel Draw; etc). CERBERUS has a new multi-windows clear and simple interface.

Cerberus Features:

This is banknote design software that has high speed and stable operation with adjustable accuracy of calculations, its review and control of a guilloche being created, possibility of various parameters real-time editing

- Colour support (CMYK model)
- Creation of irregular guilloches
- Modulation of guilloches parameters by means of different functions
- Overlaying various images on guilloche grid
- Effect of a embossed image performed by one step
- Protection against unauthorized access to documents in internal format
- Brand new mechanism of protecting the program against unauthorized copying
- Background elements – protective and decorative grids;
- Special effects based on half-tone pattern:

- Reproduction of pattern by means of micro text
- Hatch and engraving effects – representation of half-tone pictures by hatched lines of different types and width. (GuardSoft 2015)

2. Strokes Maker

This is banknote design software that create black-and-white and colour stroke vector images on basis of a source raster image. The program allows creating analogues of etchings and gravures in semiautomatic mode, enabling the painter to use tools for automatic filling of stroke areas, as well as tools for manual drawing of stroke line with subsequent automatic calculation of strokes. (GuardSoft 2015)

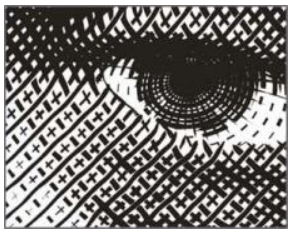


Figure 28: Banknote raster image
Retrieved from GuardSoft 2015

3. NeuroTracer

This is a banknote design software program that is aimed at a wide user group, including printing establishments, design agencies and just anyone who needs to transfer screen images in to graphics format, i.e. to vectorize bitmap graphics as well as to remove "noise" from a scanned image. (GuardSoft 2015)



Figure 30: Graphics Format Image
Retrieved from GuardSoft 2015

2.5.3 Top 10 Global Banknote Security Printing Companies

a) **De La Rue security Printing Companies:** De La Rue is a leading commercial banknote printer, security paper maker and provider of security products software solutions and is at the forefront of the battle against the counterfeiter.

De La Rue, as the world's largest commercial banknote printer, provides customers with a fully integrated range of sophisticated products and services which are available either individually or as a whole. These include a leading design capability, production of innovative security components, manufacture of security paper and polymer substrates and sophisticated printing of banknotes, all contributing to trust in the integrity of currencies.

b) **Giesecke & Devrient (G&D)** is a leading global technology provider with its headquarters in Munich, Germany, and 58 subsidiaries, joint ventures, and associated companies in 31 countries across every continent. At the end of 2014, G&D had approximately 11,450 employees and in fiscal 2014 generated total sales of 1.83 billion euros.

G&D's ethos is based on trust, security, and professional expertise. Innovative, customer-centric products, system solutions, and services make G&D a reliable partner for governments, central banks, security printers, commercial cash center operators, public authorities, and companies.

With its solutions, products, and services the G&D Banknote business unit, together with its wholly owned subsidiary Louisenthal, safeguards the trust in banknotes worldwide. The business unit, comprising the Banknote Solutions and Currency Management Solutions divisions, supports the complete cash cycle, from banknote substrate production, banknote design, and banknote printing to secure processing. G&D supplies over 150 countries around the world with its portfolio. Customers

around the world include central and commercial banks, banknote print works, cash-in-transit companies, and casinos.

G&D also supplies banks, mobile network operators, public transportation providers, companies, and original equipment manufacturers (OEMs) with end-to-end solutions comprising hardware, software, and services for mobile security applications, especially in telecommunications and electronic payments (Mobile Security business unit). The company also provides governments and public authorities with turnkey end-to-end solutions for highly secured travel documents, ID systems, and healthcare cards, which can be used for conventional identification purposes as well as for authenticating and safeguarding online business transactions (Government Solutions business unit) (www.gi-de.com 2015).

c) **KBA-NotaSys** is regarded as the main driver of innovation and excellence within the high-security printing industry. Working hand in hand with their clients and partners, they have continuously elevated the art of banknote printing to new levels. By listening to clients' needs, they have expanded their range of products and services to meet the ever-changing challenges of our market. Today, they offer a unique range of products and services to authorised security printers and Central Banks enabling them to design, produce and issue banknotes according to their specific and individual needs.

d) **SICPA**: Sicpa is a leading global provider of secured identification, traceability and authentication solutions and services. Founded in 1927 and headquartered in Lausanne, the company has become a trusted advisor to governments, central banks, high-security printers and industry.

At the core of SICPA's security expertise are high-technology security inks that protect the majority of the world's banknotes, security and value documents from the

threats of counterfeiting and fraud. They range from inks developed for printing processes including intaglio, offset, silkscreen, gravure, flexography and numbering, as well as solutions adapted for varnishing and theft deterrence systems. The comprehensive portfolio of SICPA ink solutions are developed to support all levels of authentication – from authentication by the general public, covert solutions for controllers and inspectors, machine-readable authentication through automated systems, to solutions exclusively reserved for issuing authorities and forensic investigators.

e) **Crane Currency** is a fully integrated banknote designer, printer, paper maker and security feature developer, servicing the international banknote community for over 250 years. Adherence to the highest standards of ethics and operational integrity has been instrumental in the building of long-term business relationships. Today, Crane Currency can be found in the majority of banknotes in circulation around the world. From the most traditional of cotton substrates to the most advanced Micro-Optic security elements and design, Crane is a responsive partner focused on delivering innovative products and solutions that meet clients' most demanding requirements. (www.crane.se2015)

f) **Innovia Security** is the supplier of Guardian, the world's most sophisticated banknote substrate currently issued on 78 denominations in 24 countries. Innovia Security is a trusted partner to Central Banks worldwide who use Guardian polymer substrate to deliver transformational banknote management solutions via dramatically lower counterfeits, greater durability leading to significant cost savings, a cleaner note handling experience, and a 100% recyclable banknote. (www.innoviasecurity.com.)

g) **Komori Corporation** founded in 1923, is one of the world's largest manufacturers of printing machinery for banknotes, high security print and the commercial printing

industry. Komori is a market leader for innovative design and advanced technology, providing equipment that is focused around today's demand for flexibility, quality and productivity.

h) **Royal Canadian mint** is renowned world-wide for its innovation and leadership of the global minting industry. Setting new security and durability standards by inventing multi-ply plated steel technology in the late 1990s, the Mint has continued to raise the bar by patenting new single and multi-layer plating processes for both white and yellow circulation coins. The Mint also prides itself on being innovative in all its lines of business. They are an award-winning and best-selling producer of finely crafted collector coins and medals, as well as a market leader and pace-setter in gold refining and bullion production, with achievements such as 99.999% pure gold and their flagship Gold Maple Leaf and Silver Maple Leaf bullion coins to their credit.

The Royal Canadian Mint brand stands for pride, innovation, and trust. It is by these words that they define our promise to meet the individual needs of all their customers. (www.mint.ca.)

i) **Fabriano Securities** is focused on the field of production of banknotes and security papers and security features. Fabriano Securities has created its expertise and know-how from eight decades of active presence in the security business, initially as a paper printer and then as a leading manufacturer of high security threads and holographic products developing an important know-how in the security features business. The traditional line of security threads has in recent years been complemented with the very high end of the security features now represented by the holograms, de-metallized at register. (www.fabriano.com/)

j) **Gleitsmann security Ink** is uniquely positioned to provide high security ink solutions to secure currency. GSI has a proven record of providing inks which are in use in

currencies around the world, a demonstrated record of continuous development and technological enhancements, an unblemished record of security, and most importantly, in-depth experience working with international security printers and central banks to customize solutions to meet the unique needs of each currency.

Gleitsmann Security Inks is certified according to ISO 9001, ISO 14001 and OHS 18001 and GSI has been accredited by the European Central Bank as an ink supplier for printing of Euro banknotes.

2.6 Ink

"Inks were first manufactured in both ancient Egypt and China around 250BC, Originally Ink was composition of soot bound together with gum (Kunjappu 2001). Kirk-Othmer (1981) states that Traditional ink was composed of ash, lampblack, and soot bound together with gums to make a pigment". Unlike modern ink production which is more complex, more than just a pigment and gum as it was. "Modern Ink can be organic or inorganic pigment dissolved or suspended in a solvent, Inorganic pigments (used to a lesser extent) in printing inks include chrome green (Cr2O3), Prussian blue (Fe4[Fe(CN)6]3), cadmium yellow (CdS), and molybdate orange". (Ahmed, 2007)

Printing ink is imparted by pigments rather than the dyes used in writing inks, this is because pigments are insoluble, while dyes are soluble. Ink pigments are both inorganic and organic, (Kunjappu 2011). Most white inks contain titanium dioxide as the pigment, but there are substitutes for many inorganic pigments such as chrome yellow, molybdenum orange and cadmium red with organic pigments, which offer better light fastness and reduced toxicity.

According to Young-Helmholtz colour theory, humans perceive only three broad bands of this light, blue, green and red light; any other colour of light is borne by an appropriate combination of these three 'primary colours'. 'Subtractive colours' are produced by 'subtracting' one of these three primary colours from white light. When white light strikes

an object, some of the light is absorbed and the remainder is reflected. The colour that we perceive as the colour of the object is the colour of the reflected light. (Ahmed 2007)

2.6.1 Oil Based Printing Ink

Chinese used a mixture of coloured earth, soot and plant matter banded with gum as a pigment. (Kunjappu 2011). States that Johannes Guttenberg invented the first moveable printing press in 1440. This led to the introduction of oil based printing ink with soot bound linseed oil or varnish - similar materials to those used for black inks. Coloured inks were introduced in 1772 and drying agents were first used in the nineteenth century. (Ahmed 2007)

According to Ahmed (2007), Modern inks are made of four basic components namely

Pigments - colour the ink and make it opaque.

Resins - bind the ink together into a film and bind it to the printed surface.

Solvents - make the ink flow so that it can be transferred to the printing surface.

Additives - alter the physical properties of the ink to suit different situations.

2.6.2 Printing colour

In printing technology, four different colours of ink are employed: (CMYK) **C**yan, **M**agenta, **Y**ellow and blac**K**. All other colours can be formed by 'overprinting' these colours, e.g., red is produced by overprinting yellow and magenta, as the yellow absorbs the blue light (because yellow is the emission of red and green light) and magenta absorbs the green light, leaving behind pure red light. Cyan, magenta and yellow add together to give brown colour usually.

2.7 Paper

Paper is part of our daily life; it is the universal medium on which we record our everyday history. Paper carries the past; it is the canvas of the present day and the blueprint upon which we design our future (Meggs and Purvis, 2006).

2.7.1 The origin of paper

The word "paper" originated from the ancient Egyptian plants that grew along the Nile called Papyrus, which was used as writing material as early as 300 BC by Egyptians, Greeks, and Romans for record keeping, spiritual texts, and works of art (Meggs and Purvis, 2006).

> *"The Egyptians cut thin strips from the plant's stem and softened them in the muddy waters of the Nile. These strips were then layered in right angles to form a kind of mat. The mat was then pounded into a thin sheet and left in the sun to dry. The resulting sheets were ideal for writing on. Since they were also lightweight and portable they became the writing medium of choice of Egyptians, Greeks, and Romans for record keeping, spiritual texts, and works of art. It is from papyrus that the word paper came from" (Biermann, 1996).*

The invention of real paper began in China about 105 AD by the Chinese court official, Ts'ai Lun who was referred to as god of the papermakers. (Papermaking, 2014). Ts'ai Lun was the first person to develop paper for Emperor Ho from cotton rags. (Papermaking, 2014)

2.7.2 Paper Making Process

The following are the basic steps for paper making process.

Step 1: Forestry: This has to do with the cutting of trees, which are the most common row materials used for paper making for easy transportations from the forest to the mill.

Step 2: **Debarking, Chipping and/or Recycling:** This is the second step in the paper making process, is the debarking of the wood and then chipping and crushing of the debarked wood at the mill.

Step 3: **Pulp preparation*:*** This involves washing, refining, cleaning and bleaching of the debarked wood into the slush in the beater fibre. Pulping of wood can be done in two ways: mechanically or chemically. (Kunjappu 2011)

i. **Mechanical pulp*:*** In mechanical pulp, the wood is processed into fibre form by grinding it against a quickly rotating stone under addition of water.

ii. **Chemical pulp:** In this process, woods are crushed into pure fibre, to achieve this, the chipped woods are cooked in a chemical solution. The wood pulp produced by this process is called wood free. Initially, wood pulp has a brown or brownish colour, to obtain the brightness required for white papers, it has to be bleached.

Step 4: Paper formation: In this step the pulp has to travel down the screen, water is drained away and recycled. The semi-dry web is then run through heated dryer rollers to remove the remaining water. (Papermaking. 2014)

Step 5: Paper Finishing: This is the final stage of paper productions; finished papers are mostly produced in large rolls, (i.e. 30 feet wide and weigh close to 25 tons). At this stage, paper can be cut into smaller sizes, e.g. A0, A1, A2, A3, A4 and A5.

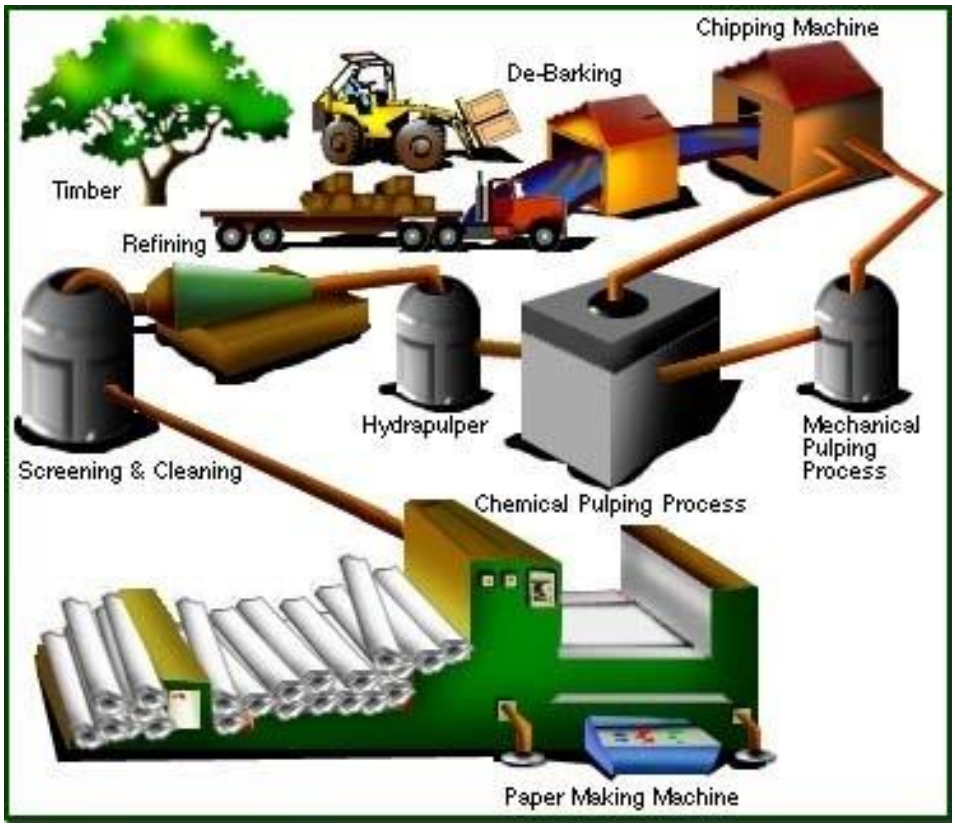


Figure 31: Paper making Process

Source: -www.papermakingmachine (2015)

Paper making Raw Materials: Wood is the most common row material in paper making process; others are water, fillers, sizing substances, dyes and additives. Fillers serve multiple purposes; they make the paper more opaque. (Papermaking, 2014)

2.7.3 Paper properties and characteristics

The basis weight of a paper is measured in grams per square meter (g/m2) under conditioned circumstances.

Brightness: is a measure for the brightness degree of the paper expressed in percentage compared with the brightness standard (magnesium oxide = 100%). (Wisconsin Paper Council, 2015)

Opacity: the opacity in paper making process has to do with the thickness value of that paper. The higher the value, the more opaque the paper is.

2.7.4 Banknote Security Paper (Bill Paper)

Banknote security paper is made of the highest quality pure cotton fibres. This composition gives it greater physical and mechanical resistance than normal paper-based products, an essential characteristic considering that banknotes pass from hand to hand many times and are not always treated "kindly". The first step in making banknote paper is to bleach the cotton fibres with caustic soda and hydrogen peroxide in water at high pressure and high temperature. After the fibres are bleached, dyes are added to the fibre pulp to obtain the specified final tint of the paper.

The second step is to "refine" the fibres, which consists of cutting and "fraying" the cotton fibres to improve both the mechanical and physical properties of the final paper. A careful balance has to be reached between fibre "shortening" and "fraying". Very short fibres will produce paper with high specific volume and good "see-through" properties together with a clear watermark, but with weak mechanical characteristics. (Giesecke & Devrient, 2015).

The third step in the process is on the paper machine. Banknote paper machines are very different to standard paper machines as they use a unique cylinder-mould process, in which the “refined” pulp is fed into a vat containing a partially submerged, wire mesh-covered mould cylinder. The fibre-mat constitutes a paper web that leaves the cylinder surface with approximately 5% of solids (fibres and additives) in 95% of water. The paper web is then wet pressed, dried, sized with chemical glue, given a final drying and pressing, and then rolled up as finished paper with 5% of water in 95% of solids in reels weighing up to 2.5 tonnes each. (European Central Bank 2015)

The last step in the process is to cut the paper reels into sheets for printing. Banknote sheets are packed in “reams” (stacks of 500) in the size required by the printing works, to accommodate from 24 to 60 banknotes per sheet. As the paperweight is 85 grams per square meter, the weight of one ream varies from 10-20 kg, depending on the actual size. (Giesecke & Devrient, 2015).

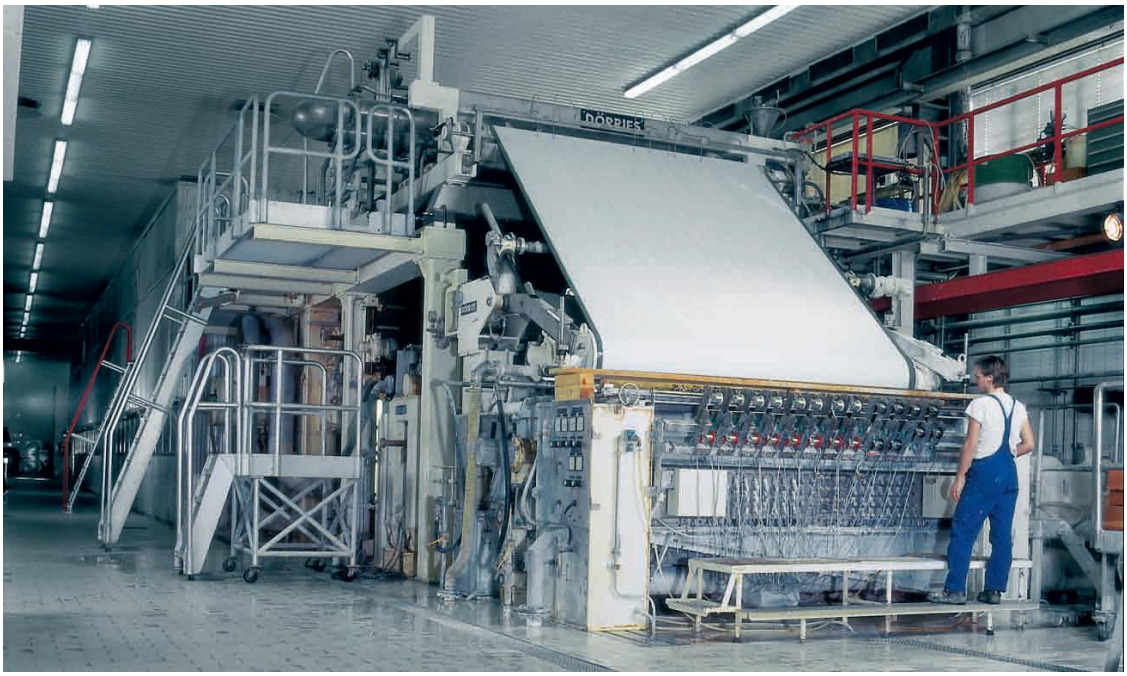


Figure 32: Cylinder mould paper machine producing a paper web

Source: -www.banknotepapermakingmachine (2015)

2.8 Security Features

Security features is the most important factor in the design of a banknote, this is because of its "resistance" to counterfeiting. The challenge of the banknote design lies in the ingenious combination of security features and artistic interpretation. When creating banknotes, the same considerations apply as when planning, developing and producing. According to European Central Bank (2015) Banknotes should be

1. Easy to recognise
2. Secure against counterfeiting
3. Aesthetically attractive.

The fulfilment of these requirements influence and restrict the creative freedom of a banknote designer. The banknotes must be clear and identifiable and should embody a cultural and political message that is readily acceptable to all.

There are various security features, methods and materials used in safeguarding valuable paper documents some of which include: (Faiola, 1999).

i. Long-lasting Economical Anti-copy Device (LEAD): This to the application of shiny metallic holographic stripe to secure a sensitive documents
ii. Shimmery Twin Effect Protection (STEP): Is an optically variable ink that produces two different colour effects from different viewing angles.
iii. Fine Intaglio Technology (FIT): Is the technique of engraving that can produce ultra-fine lines. That can enable the creation of novel security features that are unparalleled in terms of design and quality.
iv. Printed and Embossed Anti-copy Key (PEAK). This is the production of special engraves and embossed methods of producing a three-dimensional, optically variable image. The colour and information change according to the viewing angle and light

direction. Users can feel the tactile embossing with their fingers. These effects cannot be replicated by any colour copier.

v. INFACIO is a multi-level, coloured security element that combats text manipulation and image replacement in identity documents.

Other security features are thermal ink, anti-copy ink, foil printing, water mark, special paper, security threads, background decorations, micro-texts, protection ornament, crisp sound, denomination marks, mark for the blind, paper toning, polymer banknotes, erasable ink, heat-sensitive security ink, gradient colouring, anti-copy features and interface design.

2.8.1 Watermark

Paper watermark is one of the security features which are created by the use of thin wires placed the mould. It actually started in around 1282 AD. (Meggs & Purvis 2006) pointed that, by the early eighteenth century these types of watermarks started to appear in banknotes to deter counterfeiting. Today, watermark can be seen in most bank notes and some sensitive document papers which were embedded or woven into it during manufacture.

A watermark is created during the paper making process by varying the thickness of the paper and it can be viewed using transmitted light (holding the document up to a light or shining a light through the paper). A real watermark should consist of subtle changes in tone usually with both lighter and darker areas. It does not react to UV light.

2.8.2 Printing Process

Printing was invented in China through the use of woodblocks and brass castings about 3000 years ago. Dakyes (2006) asserts that printing was widely used in the past civilization to document, decorate and pass information. Meggs and Purvis (2006) states that there are two theories about the discovery of printing, the first was at the Han Dynasty regime, a carving calligraphic character was mistakenly inked and then pressed onto a

substrate from their impression form, as one does with present-day rubber stamps. The second theory about the origin of printing was related to the early Chinese practice of making inked rubbings to ensure an accurate, permanent record.

Colin (1976) states that the first printing press, with moveable type was invented in the year 1440 by Johannes Gensfleischzur Laden zum Gutenberg, born in 1398 in the German city of Mainz. As a result of technological advancement, today's printing is possible not only on paper but on many different surfaces ranging from skin, aluminium cans, plastic bottles etc. (Nakamura 2010)

2.8.3 Origin of printing in Nigeria

Adeniyan (2010) states that, the emergence of contemporary printing in Nigeria began in 1946 at the Hope Waddel Press Calabar. However informal training in printing education started in 1952 at the Yaba Technical Institute which later metamorphosed into Yaba College of Technology. (Afolabi, 2012).

The printing industry, like other sectors of the Nigerian economy, relies on skilled manpower to run profitably. So, the opportunities in the printing industry are endless. There are numerous job prospects available for graduates of printing programs in the commercial printing industry, publishing industry, packaging industry, advertising industry, government institutions (publication units) and corporate affairs units of organizations. (Papermaking, 2014). Printing process can be described as the systematic technique of transferring image on to a substrate (paper, fabrics, leather and so on). Over the centuries, there were many different ways of putting ink on substrate to make an impression, which mark the beginning of printing processes (Faiola, 1999).

2.8.4 Printing of banknote

Most of the banknotes entail four printing techniques; offset, intaglio, silkscreen and letterpress. Different types of plates or forms and special inks are used for these processes. Printing of high-denomination banknotes usually starts with offset printing, providing the pattern for the graphic background of the banknote (Papermaking, 2014). Offset printing is an indirect printing technique, as the inks are not directly printed from the plate onto the paper. Rather, they are first transferred from four printing plates (each clamped to a print cylinder) onto a rubber printing blanket. From there, the inks are transferred onto the paper. The special configuration of the offset machines used for euro banknote printing means that the front and back of the banknote are printed simultaneously (Papermaking, 2014).

2.8.5 Types of printing

There are five major types of printing processes, such are relief printing (letterpress, flexography), Plano graphic printing (offset lithography), recess printing (gravure/intaglio), stencil printing (screen), digital printing (toner and inkjet) (Meggs & Purvis, 2006)

Relief printing: A letterpress technique of printing is one of the oldest printing techniques. In this technique the image areas are raised above the non-image areas, the process involves printing images by the relief and raised technique of printing. The rollers are laden with ink and they pass it to a separate ink bed; a fresh film is picked here for the following sheet of paper. A sheet of paper is pressed onto a type, swung back again and finally removed. A new sheet or roll of paper is again inserted at this place (Ahmed, 2007). Relief printing is the printing technique in which the inked area is raised above the non-inked surface just like a rubber stamp does (Adeniyan, 2010).

Meggs and Purvis (2006) stated that Relief printing was the earliest form of printing and remained the most dominant for a very long time. According to Heij (2012), Letterpress originated in 1440 by Gutenberg. Originally, letterpress printing surfaces were prepared by

assembling thousands of pieces of metal type on which individual letters or letter combinations were cast in relief to create pages of text called type forms.

There are two types of letterpress printing machines: - Flat-bed cylinder and Rotary Letterpress Printing (Ahmed, 2007).

Flat-bed cylinder- In Flat-bed Cylinder technique, the inking roller and an ink fountain supply ink to the plate cylinder. The plate is locked to a horizontal or vertical bed, which passes over the inking roller and then against the substrate (Adeniyan, 2010). As the substrate moves from the feed stack to the delivery stack, it passes around an impression cylinder. In other words, a single revolution of the cylinder moves over the bed while in a vertical position so that both the bed holding the substrate and cylinder move up and down in a reciprocating motion. Either one or two-colour impressions can be printed by Flat-bed cylinder presses, which operate in a manner similar to the platen press and print stock as large as 42 inches by 56 inches. These presses operate very slowly unlike lithographic technique of printing.

Rotary letterpress printing- Rotary Letterpress Printing is the most popular type of plates used in stereotype, electrotype, and moulded plastic or rubber. These presses use heat-set inks and are equipped with dryers, usually the high-velocity hot air type, when printing on coated papers. These are of two types: sheet-fed and web-fed. (Ahmed 2007)

Flexography: This process adopts the same principle of relief printing which is similar to letterpress. The printing surface is made of rubber instead of metal. This is the process of using soft plates and highly fluid inks to make a printing on nonporous materials such as foil laminates and polyethylene. (Meggs & Purvis, 2006) Flexography is mainly used for packaging products, grocery bags, gift wrap, and can and bottle labels. Flexography is another type of relief printing. It uses flexible rubber or photopolymer plates to reproduce. Adeniyan (2010) states that In the 1970s photopolymer plate materials were introduced, and

the time required to manufacture and mount a set of plates was reduced significantly. This has allowed the process to enter new markets, most notably newspaper printing. In addition, water-based inks can be used in flexography.

Offset lithography: Offset Lithography is the most dominant of the printing processes. According to Adeniyan (2010), he observes that most commercial printers do offset printing, it accounts for over 65% of the printing process globally. Lithography is directly opposite to Letterpress technique, is more of a mechanical process. In offset lithography, a printing plate which is most often made from aluminium contains an image of the content that needs to be printed. When the plate is inked, only this image part holds ink. That inked image is subsequently transferred (or offset) from the plate to a rubber blanket and then to the printing surface. The process can be used to print on paper, cardboard, plastic or other materials, but these have to have a flat surface.

Offset work with the principles of water doesn't mix with oil. Ink in offset moves from metal plates to a rubber blanket (cylinder) to the paper.

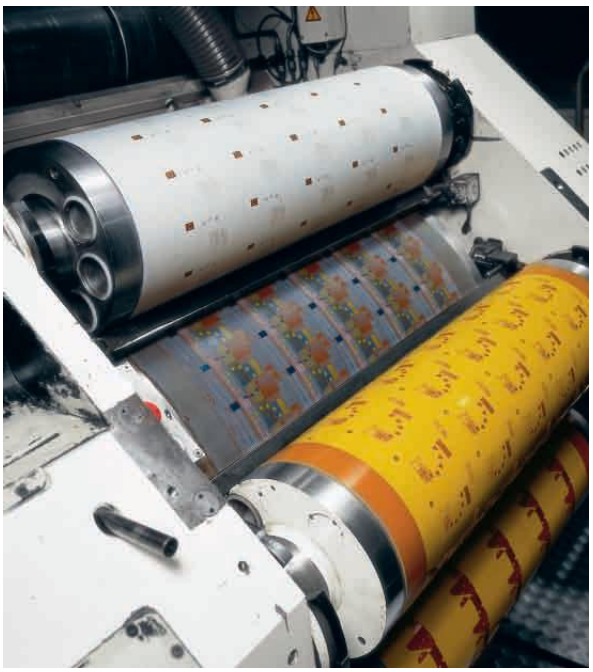


Figure 33: Offset Printing Machine

Source:-www.banknotemachineoffset (2014)

Features of lithography

- Printing from right-reading planographic (flat) plate to blanket and substrate
- Basic principle: "ink and water don't mix"
- Principal applications: publications, packaging, forms, general commercial printing, labels, books, etc.
- Recognition characteristics: sharp, clear images

Gravure: gravure is another form of direct printing process, in this technique the image is directly transferred from the image carrier, which is usually a cylinder, onto the substrate. Gravure is in contrast to letter press because it's printing from recent part of plate. This enables gravure to print a wide range of grey tones and thus to render excellent printing.

Gravure is called intaglio because the image areas are in a sunken area and the non-image areas are relief. Gravure printing or intaglio is good at printing of magazines, newspapers, and catalogues, textiles, wall paper, plastic laminates, and postage stamps. A gravure press is constructed with two cylinders per unit, a printing cylinder, which carries the image and an impression cylinder. (Afolabi 2012). Adeniyan (2010) states that, cylinder has a number of tiny cells in it, around 50,000 to a square inch. The cells are protected by walls that are in relief. The surface of the cylinder is plated with copper to hold the image. The image is transferred photographically to the electroplated copper surface. The non-image areas on the copper are chemically etched or mechanically engraved to form the cells. Each cell varies in its depth, and this enables each cell to transfer varying densities of ink to produce tones.

The printing cylinder rotates in a trough of liquid ink. During this motion, the ink fills the cells of the cylinder and inks the image areas. However, the non-image areas also get inked as they are in relief. This excess ink is wiped clean by a blade called a doctor blade. The doctor blade is positioned at an angle over the cylinder so that when the cylinder rotates, the excess ink that was picked up by the non-image areas are wiped clean (Papermaking, 2014). In the

continuing motion of the cylinder, the paper (or the substrate) is fed in between the printing cylinder and the impression cylinder.

By pressure, the ink in the cells is forced out onto the substrate. Since the printing image is made of copper, which is quite expensive, gravure is usually used for very long-run jobs which it handles well because the image is placed on the cylinder directly, and on copper, which is a strong metal. Traditionally gravure has been used by markets that have a need to produce long run and consistently good quality printing. Packaging and some long run publications therefore employ this printing process.

Most gravure presses are web-fed. Some are as large as 16 feet wide. The gravure process is used for specialty products like wall paper and vinyl. Adeniyan (2010) admitted that Gravure presses can print at incredible speeds like 2500 feet per minute. So, one can imagine that unless the job calls for huge numbers to be reproduced, in high quality, gravure as a process cannot be chosen (Afolabi, 2012).



Figure 34: Intaglio Printing Machine
Source:- www.banknotemachinegravure (2014)

Gravure features

The following are the features of Gravure:-

- Printing from wrong-reading recessed image cylinder direct to substrate
- Three major segments: publications, packaging, and specialty product printing
- Principal applications: packaging, long-run magazines and newspaper inserts, catalogues, wallpaper, postage stamps, plastic laminates, vinyl flooring
- Recognition characteristics: serrated edge to text letters, solid colour areas
- Relatively short make-ready times on press, high colour consistency, continuously repeated image
- Cylinders last forever, making repeat runs very economical
- Cost of making cylinders remains high, making gravure expensive for jobs that are not repeated or not extremely long.
- Trend is toward removing chemistry from cylinder-making procedure, increased use of water-based inks.
- Breakthroughs anticipated in electron-beam engraving and photopolymer-coated cylinders (Papermaking, 2014).

Screen printing: Screen printing is a printing technique that uses a woven mesh to support an ink blocking stencil. The attached stencil forms open areas of mesh that allows ink to transfer onto the material. A roller is moved across the screen stencil, forcing or pumping ink past the threads of the woven mesh in the open areas.





Figure 35: Screen printing technique

A
Manual screen printing
Source:- Photograph by Isa Musa (2014)

B
Digital screen printing
Source:- Photograph by Isa Musa (2014)

Screen printing or silk-screening, is the simplest technique of printing. Screen printing technique is done by forcing ink through a screen using a stencil pattern. Silk, nylon, stainless steel fabric-shirts, signage, point-of-sale displays, decals, and truck signage (Colin,1976).

The image that needs to be printed is first captured on a photographic material, a positive usually. A silk screen is stretched tightly by hinging around a wooden frame. The process derived its name from this silk screen, which was used as the image carrier. The positive image is then transferred to the screen and developed. The image that has been transferred to the silk screen is on the porous area of the screen. The non-image areas are blocked out during the stage of image creation itself.

The screen is laid over the substrate that is to be printed and ink is poured on the frame over the screen. The ink is then wiped across the surface of the screen using a device called a squeeze. A squeeze is a wooden device that has a rubber blade. It facilitates the smooth flow of ink over the screen. Since the screen is porous in nature, the ink flows through it. Because the image areas are porous, they allow ink to flow through them. This ink is thus printed onto the substrate beneath (Afolabi, 2012).

Printing capability: Since the printing surface in the screen printing process is very flexible, it allows printing on three-dimensional objects too. This is something that the printing processes discussed earlier cannot offer. A substrate that is two-dimensional and flat is all

that can be fed into those machines; in the case of screen printing, the printing surface itself can be wound around the substrate. So, objects like cups, mugs, watches or other irregular-shaped products can be printed upon using the screen printing process (Colin, 1976).

Although this description of screen printing may sound quite simple, in reality there are screen printing presses that are as automated as any other printing presses. Multi-colour printing presses employing screen printing process with capability to print on different substrates like polyester, metal, and pressure-sensitive materials are today a common scenario. These presses are equipped with online corona (electrostatic) treatment, and can even combine ultraviolet drying in some colour units (Papermaking, 2014).

Screen printing features

i. Printing by forcing ink through a stencilled screen mesh image directly onto substrate
ii. Principal applications: can print on any substrate: point-of purchase displays, billboards, decals, fabric, electronic circuit boards, glasses, etc.
iii. Ink formulation, screen mesh count, and image type are major quality factors
iv. Recognition characteristics: heavy, durable, brilliant layer of ink

Direct Imaging Technology

Adeniyan (2010) states that since the early 1980s, printing and publishing technology has been evolving new methods for production of digital imaging. Before going further, let's define what exactly a digital image is. The term digital literally means "composed of numbers," so a digital image is an image that is composed of numbers.

Direct image technology is a form of printing processes invented by Heidelberg that is so easy, faster and neater. These technologies include Computer to Press (CTP). This technology takes the data straight from the computer that acts as its front end and images the

plate directly on the press. The spirit of offset printing is very much alive in presses that incorporate the direct imaging technology (Adeniyan, 2010).

Engraving Method of Printing

Engraving produces the sharpest image of all. Steel dies are cut or chemically etched to hold ink. Paper's forced against the plate using tremendous pressure, causing an embossed (raised) impression. Run your fingers over the back side of the sheet and you'll feel the engraving. It's a dead giveaway (Papermaking, 2014).

Thermography Method of Printing

Thermography is a less expensive alternative to engraving if you want raised printing. It uses special powder that adheres to any colour ink. Uses include all sorts of stationery products. It doesn't require a die, as does engraving (Afolabi, 2012).

Reprographics Method of Printing

Reprographics is a general term describing copying and duplicating. Think in-house copying departments and copy or quick printing shops. (But today, every job is a quick printing job, isn't it?) Duplicates are made of your originals (Adeniyan, 2010).

2.9 Theoretical Framework

According to Osuala (1992), the word theory as an attempt to synthesize and integrate an empirical data for maximum clarification, Additionally, McQuail (2006) also defined a theory as an interrelated and testable set of propositions that explain a phenomenon. In order to understand and explain the reason the forgery and counterfeits of Ahmadu Bello University’s Sensitive documents and protect them against forgery and counterfeiting, differential association theory will be adopted. .

2.9.1 Differential Association Theory

The theory was developed by Edwin Sutherland in 1939, adapted in Adeta, (2014). He aims at addressing the issue on how people learn deviance. This theory explains deviance in

terms of the individual's social relationships. According to this theory, the environment plays a vital role in deciding which norms people learn to violate, specifically people within a particular environment. People also learn their norms from various socializing agents such as the parents, teachers, friends, co-workers and others. In short, people learn criminal behaviour, like other behaviours, from their interactions with others, especially in intimate groups.

The principle of differential association asserts that a person becomes criminal because of an "excess" of definitions favourable to violation of law over definitions unfavourable to violation of law. What this means is that an individual will become a criminal because he is exposed to more favourable criminal influences rather than more favourable legal influences. In other words, criminal behaviour emerges when one is exposed to more illegal activities than legal activity. This can be seen in environments with poor socio-economic conditions which may encourage negative views towards the law and authority.

This theory is significant because it puts an individual's social environment into context as a means to explain why some individuals engage in criminal activities.

The theory has the following assumptions:

i. Criminal behaviour is learned. This means that criminal behaviour is not inherited. This assumption proposes that individuals are inherently good and only turn towards deviant behaviour as a result of learning the behaviour.

ii. Criminal behaviour can be learned as the result of interaction with criminals through watching and interacting with other individuals who are engaging in the criminal activities.

iii. The principal part in learning criminal activities occurs within peer groups. This factor makes a great deal of sense since the process of socialization and growing up is heavily influenced by the groups of people that an individual is a part of.

iv. When criminal behaviour is learned, the learning includes techniques of committing the crime, which are sometimes very complicated; this means that an individual will be influenced into believing that the behaviour which they may have previously believed was wrong,

v. An individual will be pushed into deviant behaviour depending on their view of the legal code as being favourable or unfavourable, that is an individual may be driven into abnormal behaviour if they see the laws as being tough and unfair, this would influence their rationalization for breaking the law since they view it as unfair.

vi. A person becomes antisocial because they see more reasons to break it than to stay in compliance with it. In their minds, individual would take a look at a law and compare the rewards for both actions and make their decision based on the one which would benefit them the most. This is to say most of our youths are involved in forgery and counterfeits activities without knowledge of the legal implications.

vii. Differential associations may vary in frequency, duration, priority and intensity. This factor would be attributed to how strong their bond is with the individuals they interact with who commit the criminal behaviour. If they interact on a daily basis and have strong emotional ties then they are likely to commit the deviant behaviour more frequently than they otherwise would have.

viii. The process of learning criminal behaviour by associating with criminal is remains the way of learning anti-criminal behaviour. This means that individuals learn criminal actions and legal actions through the same way. An individual would learn behaviour that is counterproductive to society in the same way that they would learn behaviour

that is productive. This is why an individual would learn criminal behaviour through their interactions with others.

ix. The final postulation of differential association theory states that while criminal behaviour is an expression of general needs and values, it is not necessarily the fulfilments of these needs and values which cause deviant behaviour since non-criminal behaviour is an expression of these same needs and values.

In addition, according to the seventh postulation of differential association, the more time an individual would spend with members of these groups who are committing illegal acts; the greater the frequency of engagement in deviant behaviour (Adeta, 2014).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter specifically presents the methods and procedures used in collecting, selecting and the treatment of data used for this study. It is made up of the following areas: selection of research design, population of the study and description of the instruments, procedures for the collection of data, and the method of statistical analysis of data.

3.1 Research Design

Rajasika *et.al* (2013) describes research design "as a structural plan and strategy of investigation conceived to obtain answers to research questions and to control variance". In order to achieve the desired objectives of this study, experimental and practice-based research methodology were employed. The justification for the adopting of experimental research design lies in the fact that the topic; Adaptation of Banknote Security Features on Ahmadu Bello University Sensitive Documents is experimental in nature. Bature (2014) uses experimental research design in investigating a similar study; his results were found to have both internal and external validity. Sullayman (1999) defines research design as "the arrangement of conditions for the collection and analysis of data in a manner that aims at providing both external and internal validity of the findings of the investigation". Osuala (2006) describes research as "the process of arriving at dependable solutions to problems through the planned and systematic collection, analysis and interpretation of data".

3.2 Population of the Study

The population for this study were drawn from the following:-

- 27 Ahmadu Bello University sensitive documents

- 86 Latest security features and materials found on banknotes and other secured paper documents
- 178 Professional graphic designers and Printers working in the selected security printing companies in Nigeria

3.3 Sample Size and Sampling Procedure

Sample is a subgroup drawn from population which is generally large. In other words, the sample is a representative portion of the entire population and is expected to have similar characteristics of the actual population. In reality there is no enough; time, energy, money, labour/man power, equipment, access to suitable sites to measure every single item or site within the parent population or whole sampling frame. For the purpose of this study, purposive sampling technique was used. The main reason for using purposive sampling technique was to enable the researcher focus on particular characteristics of the population that are of interest, which was enable the respondents to answer the research questions. For this reason, the researcher x-rayed 86 different banknote security features globally, out of which 15 were selected for adoption on Ahmadu Bello University sensitive documents. Additionally, a total number of the 49 copies of questionnaire for printers and graphics designers were distributed to the following security printing companies in Nigeria which are:

i. Nigerian Security Printing and Minting Company Plc., Lagos
ii. Nigerian Security Printing and Minting Company Plc., Abuja
iii. Yalliam Press Abuja
iv. Euphoria Security Printing, Kaduna
v. Clear Impression Press, Kano

Others are some selected personnel from Ahmadu Bello University Security unit who were interviewed and also constituted population of this study.

3.4 Materials

The Materials that were used for the studio work are as follows

i. A computer that have 2500.0 MHz, 320 Gigabytes drive, Intel CORE i3 model
ii. Corel Draw x3
iii. Adobe creative Suite 6.
iv. Digital Camera
v. Banknotes and other sensitive paper documents
vi. Printer
vii. Fake detecting machine
viii. Internet facility

3.5 Instrumentation

Nelson, (2010) defined Instrument as 'any device systematically designed for collecting data, such as test, questionnaires, oral interview, and observation methods'. Hence, for the purpose of this study, the instruments used to obtain information for this study include: questionnaires, oral interview, and observation methods to elicit relevant information.

3.6 Instrument Validity and Reliability Test

In this approach, copies of the developed questionnaire were given to a panel of experts for validation, to ensure that the questionnaire and interview questions are up to standard and can elicit the required information needed for this study. This was through constructions and re-evaluation of the questionnaires by the experts in the field. On the other hand, it was importance to check the reliability of the instrument. Therefore, the reliability of the instrument was tested through the pilot test prior to conducting the main research. This is to ascertain if the content of the instrument is understood by the respondents.

3.7 Pilot Study

A pilot test in research simply means a trial to test the reliability of the instruments used in conducting the research. However, in order to get accurate and reliable information for this study, a proposed sample of the redesigned Ahmadu Bello University sensitive documents alone with questionnaires was to professional graphic designers and printers. Post-graduate students and lecturers from Graphics section of the Department of Industrial Design Ahmadu Bello University, Zaria and printer from Ahmadu Bello University press ware used for assessing the possibility of archiving the objectives of this study through the reconstructed questionnaire and interview.

3.8 Procedure for Data Collection

The procedure for data collection provides guidelines for the selection, processing, analysis and reporting of findings for this research. These procedures are intended to help to improve the usefulness, accuracy and comparability of data. For the purpose of this study, experimental research design was used for data collection. The instruments used for the collection of data for this study were structured five point likert-scale and Yes or No, questionnaire, interview, observation and Photographs/banknotes. A total of 49 copies of the questionnaires were administered to the respondents from the top five security printing company in Nigeria, out of which only 42 copies questionnaires were found to be useful for analysis.

3.9 Studio Work

According to Dakyes (2006), “For a security designer to come up with a secured and protected document, there is need to embark on a research work and review of old and new security features as well as the latest printing technologies’’. For the purpose of this study,

the work procedures are discussed under the following headings, which are exploration, developmental and production stages respectively.

3.9.1 Exploratory Stage

The attempt at Security Printing started from collecting, observing, and studying of the exiting documents for practical exploration. This stage captures the compositional unit of security features for adaptation on some Ahmadu Bello University's sensitive documents in order to protect them against forgery and counterfeiting.



Figure 36: Guilloche Lines
Source: - *www. letestbanknote security features.com*(2015)



Figure 37: Security Treat
Source: - *www. letestbanknote security features.com* (2015)



Figure 38: Bimetallic Stripe
Source: - ***www. letestbanknote security feature***



Figure 39: Graphic vector
Source: - banknotesecurityvector (2015)



Figure 40: Hologram Feature

Source: - ***www.alamy.com*** **2015**



Figure 41: Hologram Feature
Source: - www.alamy.com AOTXC92015

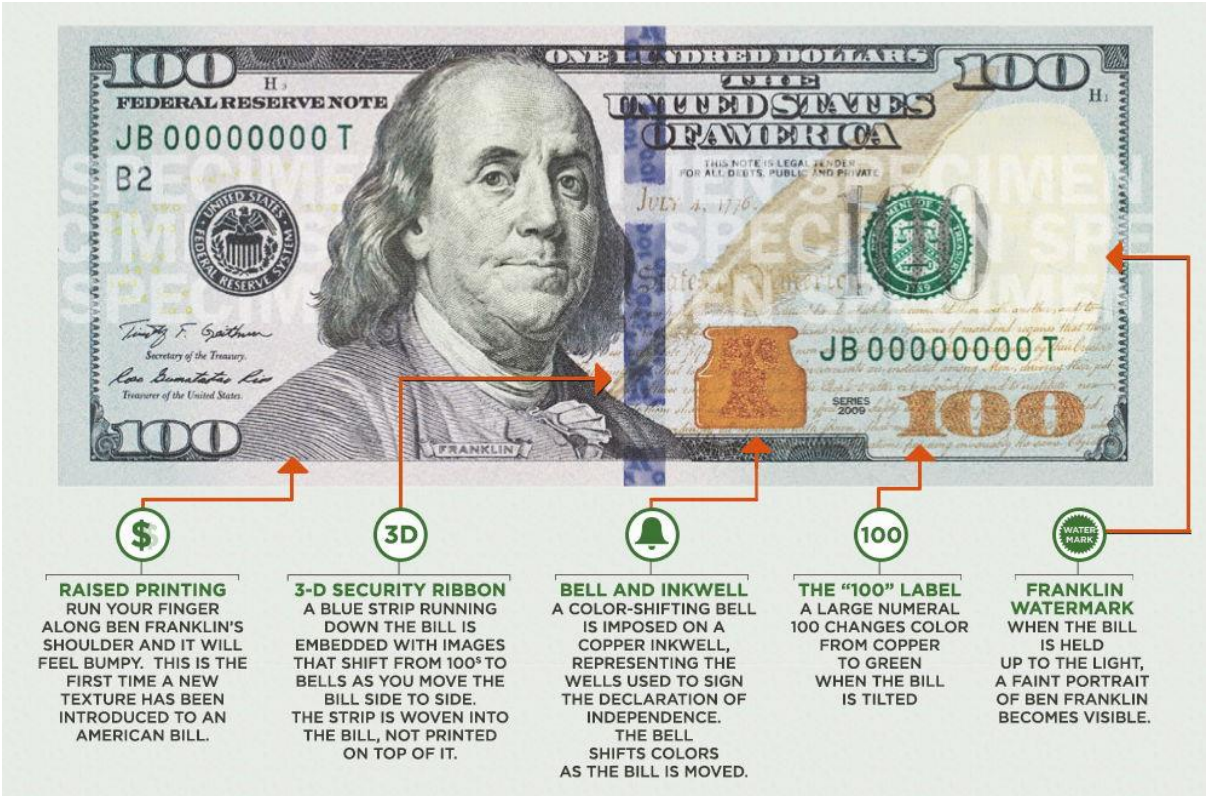


Figure 42: Security Features of the New United States Banknote

Source: - *http://www.newmoney.gov/uscurrency/redesigned100.htm* (2015)

It is well known that the most counterfeited currency in the world is the United States Dollar, in particular the 100-dollar banknote. More popularly known as "Benjamin's"

because of its imprinted image of Benjamin Franklin, the new features now instituted in the most recent designs of the bill are designed to thwart the efforts of counterfeiters and money launderers.

The United States Federal Reserve started issuing the new bank notes to banks in 2013. In a statement made by Federal Reserve Board Governor, Jerome Powell, "The new design incorporates security features that make it easier to authenticate, but harder to replicate."

According to a statement issued by Sonja Danburg, the Program Manager for US Currency Education of the Federal Reserve, the same year, about 3.5 billion of the Benjamins were stockpiled, and $900 billion worth of $100 notes were in circulation. She added that nearly two-thirds of the volume of these notes was located overseas.

The following are the safety features incorporated into the new $100 banknote:

i. **Security Thread.** A new security thread has been embedded into each note running vertically across the bill. The thread has the words "USA" and "100" embedded in it. These numbers can clearly be seen when the bill is held to a light source.

ii. **3D Security Ribbon.** This security ribbon, which is woven into the paper, has a visual security feature embedded in it. When the bill is tilted back and forth, two things happen: The bells would change to 100s, and the bells and 100s move side to side. When tilted from side to side, the bells and 100s move up and down.

iii. **Bell in the Inkwell.** When the note is tilted, the colour of the bell embedded in the note would change colour from copper to green.

iv. **Symbols of Freedom.** On the right part of the bill, an image of the Quill used by the Founding Fathers in signing the Declaration of Independence is imprinted. Also embedded in the bill are phrases taken from the historic document.

Source: - *http://www.newmoney.gov/uscurrency/redesigned100.htm* (2015)



Figure 43: Security Features of the Canadian Note
Source: - www.bankofcanadamuseum.com (2015)

The Canadian $20note was introduced to upgrade the security features that appear on it. Bank of Canada Museum (2014) explains the following security features on it.

i. **Metallic stripe**

Tilt the note. The numbers and maple leaves change colour.

ii. **Ghost image**

Hold the note up to the light and look through it. A small, ghost-like image of the portrait appears. It is visible from both sides of the note.

iii. **Dashes**

Hold the note up to the light and look through it. The dashes form a solid line. It is visible from both sides of the note.

Tilt the note. The dashes shift from gold to green. Small characters (e.g., CAN 20) match the note's value.

iv. **Puzzle number**

Hold the note up to the light and look through it. Irregular marks on the front and back of the note form a complete number. It is visible from both sides of the note.

v. **Raised ink**

Feel the raised ink on the shoulders of the portrait, the large number, and the words "Bank of Canada • Banque du Canada."

vi. **UV feature**

Look at the note under UV (ultraviolet) light. Check that the text BANK OF CANADA – BANQUE DU CANADA and a number matching the note's value glow in interlocking red and yellow. Red and yellow fibers are scattered on both sides of the note.

Source: - www.bankofcanadamuseum.com (2015)



Figure 44: Security Features of the Indian Banknote (rupee)
Source:-Indian%20Rupee%20in%20Detail%20_%20Bemoneyaware.htm (2015)

The following are the safety features incorporated into the Indian rupee note:

a. Observe through Register: The small floral design printed both on the front (hollow) and back (filled up) of the note in the middle of the vertical band next to the Watermark. The design will appear as one floral design when seen against the light.

b. Optically Variable Ink (OVI): 500 numbers looks missing in green colour while seen straight. When the note is tilted to certain angle it is seen in blue colour. The numeral 1000 and 500 on the obverse of Rs.1000 and Rs.500 notes respectively is printed in optically variable ink viz., a colour-shifting ink. The colour of the numeral 1000/500 appears green when the note is held flat but would change to blue when the note is held at an angle.

c. Latent Image: On the obverse side of Rs.1000, Rs.500, Rs.100, Rs.50 and Rs.20 notes, a vertical band on the right side of the Mahatma Gandhi's portrait contains a latent image showing the respective denominational value in numeral. The latent image is visible only when the note is held horizontally at eye level.

d. Identification Mark: If we touch circle with intaglio Print we can identify the denomination number. This is useful for the persons with defective eye vision.

e. Water Mark: : In Obverse side of note, the Mahatma Gandhi Series of banknotes contain the Mahatma Gandhi watermark with a light and shade effect and multi-directional lines in the watermark window.

f. Intaglio Printing: The portrait of Mahatma Gandhi, the Reserve Bank seal, guarantee and promise clause, Ashoka Pillar Emblem on the left, RBI Governor's signature are printed in intaglio i.e. in raised prints, which can be felt by touch, in Rs.20, Rs.50, Rs.100, Rs.500 and Rs.1000 notes

g. Security thread: Security thread with 3 mm width having letters 'Bharat' in Hindi and RBI seal is present. Colour changes from green to blue when seen in different angles. Greenish on the reverse side, florescent text is visible when seen under ultraviolet light. Long line of thread will be visible when seen in light.

h. Micro lettering: This feature appears between the vertical band and Mahatma Gandhi portrait. It contains the word RBI in Rs.5 and Rs.10. The notes of Rs.20 and above also contain the denominational value of the notes in micro letters. This feature can be seen well under a magnifying glass.

Source:-Indian%20Rupee%20in%20Detail%20_%20Bemoneyaware.htm (2015)

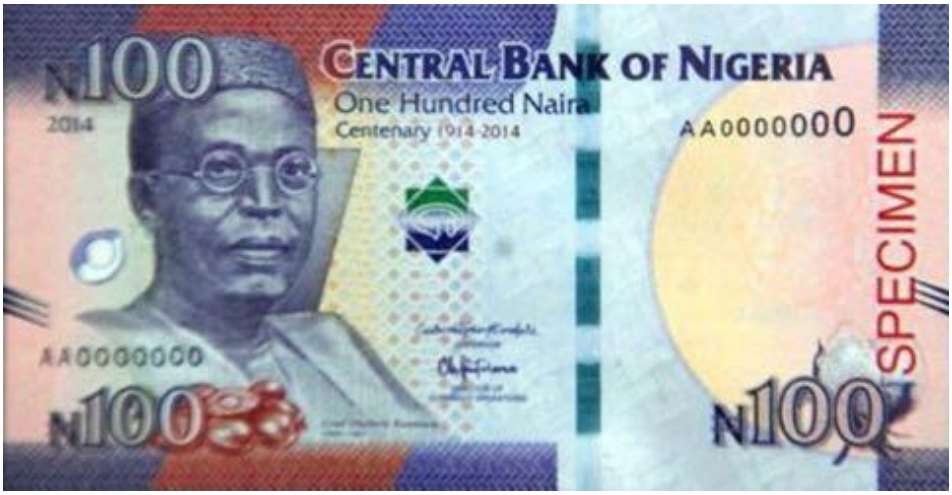


Figure 45: Security Features of the **100 Naira note**
Source: - www.cbn.com (2015)

The following are the safety features incorporated into the new Nigerian N100 banknote:

The New N100 Naira notes are protected by a number of security features to enable the recognition of genuine notes. The distinguishing features which can immediately be recognized by touch and visibility are raised print, the security thread and the watermark. Other areas such as the portrait, lettering and the denominational numerals on the front and the back are embossed. The raised print provides the facility, while the security thread, which ordinarily, looks broken but is not when held against the light, has CBN in small lettering printed on both sides of the notes.

The Naira notes are also protected against photocopying. There are features, which are visible under ultraviolet light, for example, the serial number on each note is black, but turns green under ultraviolet light. The front side of the note is a public authentication feature, window micro-optics, showing the national flag and numeral 100 indicating the value of the denomination and the attainment of the centenary period.

The second is a spark feature of a rolling manila bar which was the instrument used during the slave trade era. A portrait of Chief Obafemi Awolowo is retained both in the ink, that is the interglow level, as a portrait and also in a paper as a shadow image**.**

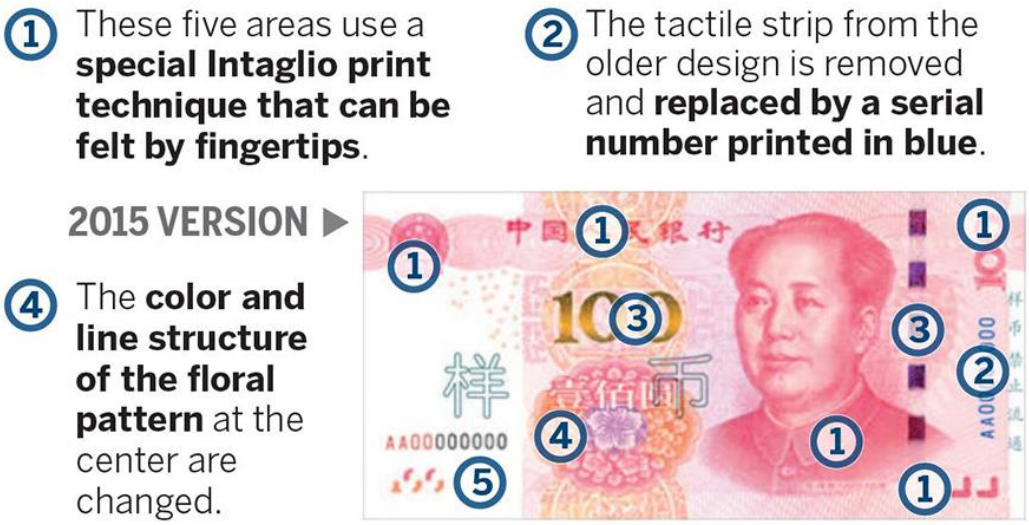


Figure 46: Security Features of the **China banknote**

Source: - www.bankofchanamuseum.com (2015

China banknote has the following Security Features

a. The Intaglio Print

b. Watermark

c. Optical Variable Ink

d. Window Thread

e. Latent Image

f. Optical variable device

g. Metallic ink and embossed figure

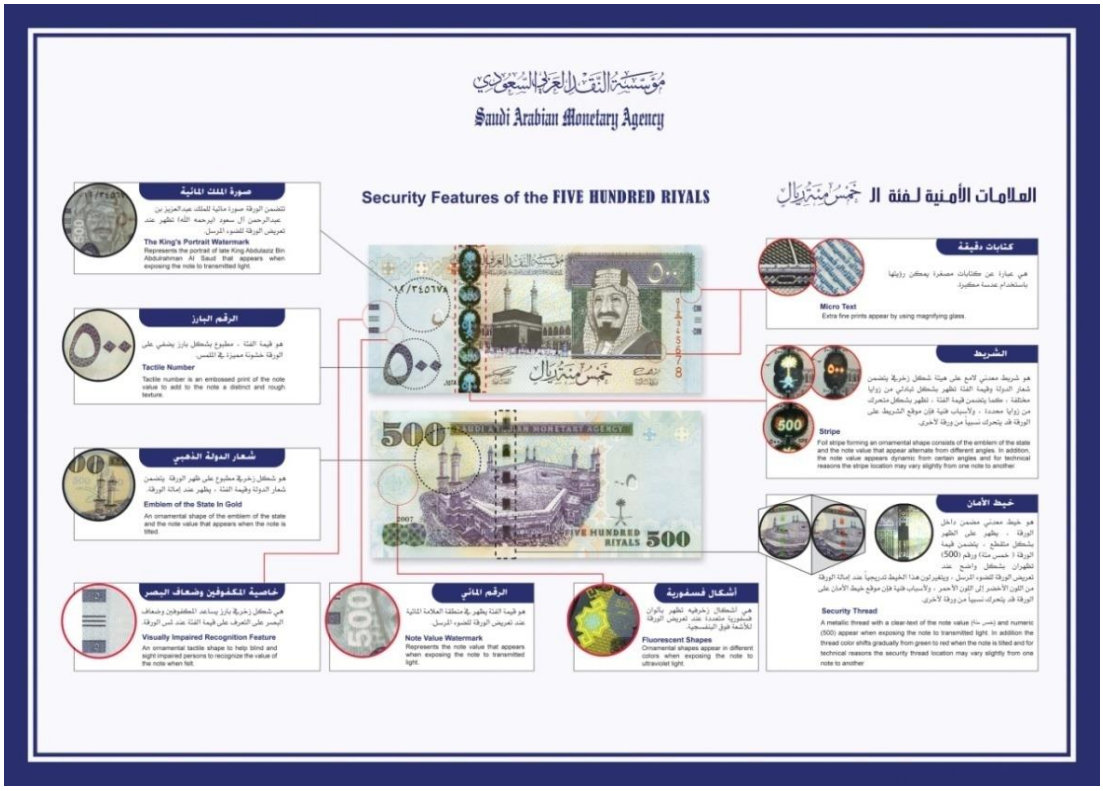


Figure 47: Security Features of the 500 note of Saudi Riyals
Source: - www.bankofchanamuseum.com (2015

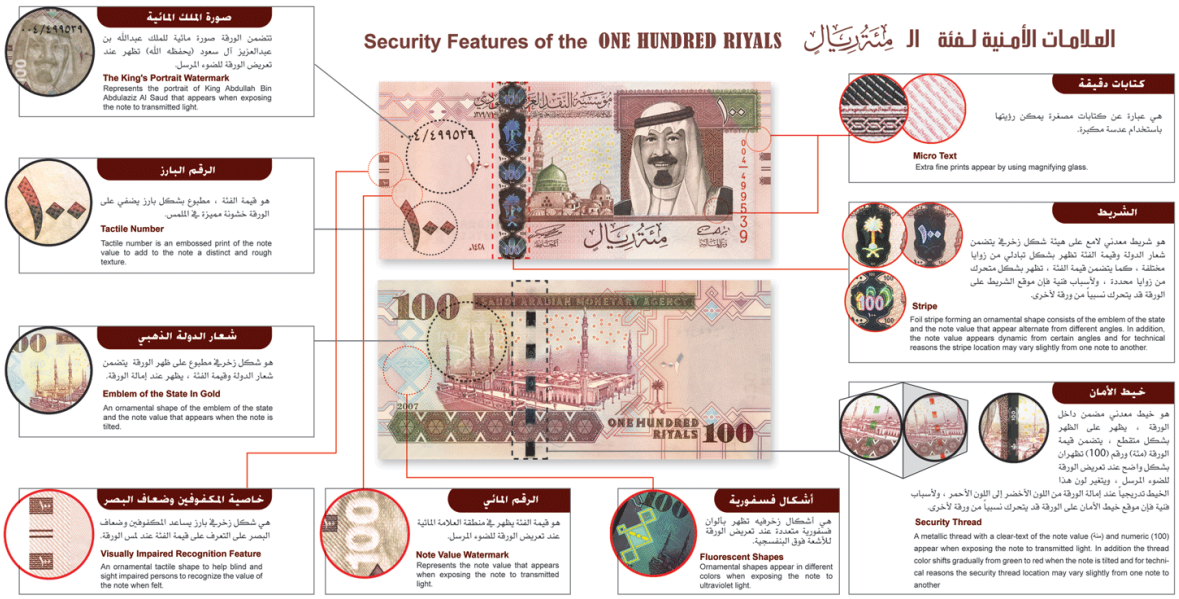


Figure 48: Security Features of the 100 note of Saudi Riyals
Source: - www.bankofchanamuseum.com (2015)



Figure 49: Security Features of the 10 New Zealand Note
Source: - www.bankofchanamuseum.com (2015



Figure 50: Security Features of the 10 New Zealand Note
www.banknotemuseum.com

3.9.2 Developmental Stage

Mamza (2008) opined that since research and deployment is meant to design or redesign and validate products as well as translate the research findings usable items, some of the major steps involved are as follows: develop the preliminary forms of the product being

considered and evaluate the product as it relates to terminal objectives. Dakyes (2009) asserts that there are so many paper documents security components, which can be classified into four basic areas: Ink, paper, design and printing process. At this stage, the researcher redesigns and carefully adapted banknote security features on the selected Ahmadu Bello University's sensitive documents for protection against forgery and counterfeiting.

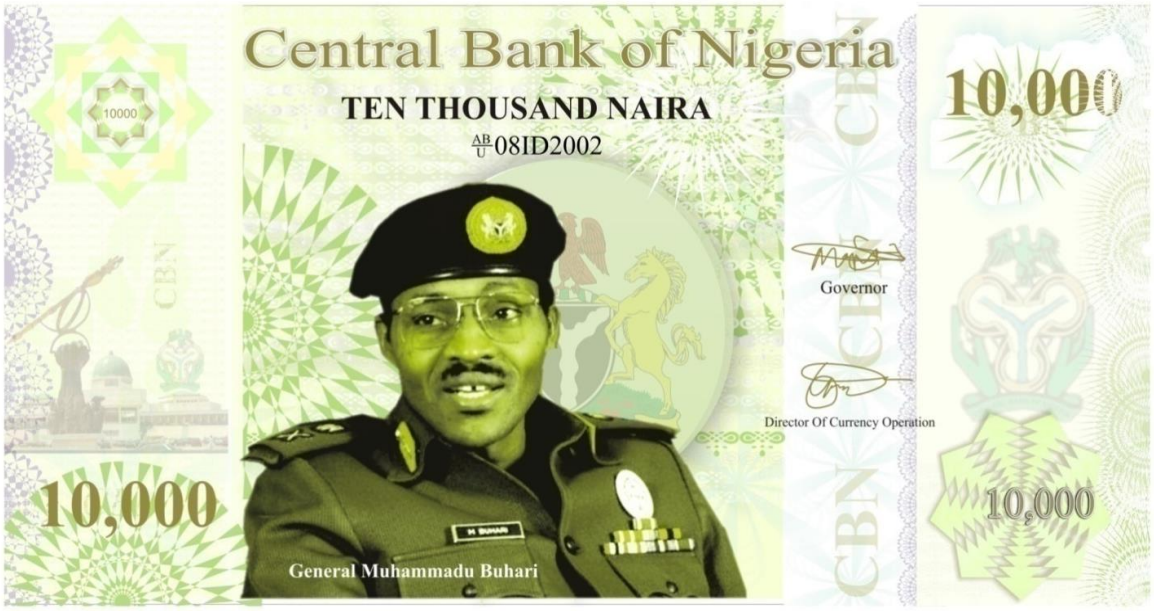


Plate 1: Proposed 10, 000 Naira Note

Source: - *Hashim* 2011





Plate 2: Proposed 5, 000 Naira Note

Source: - *Hashim* 2013



Plate 3: Proposed 5, 000 Naira Note

Source: - *Hashim* 2015

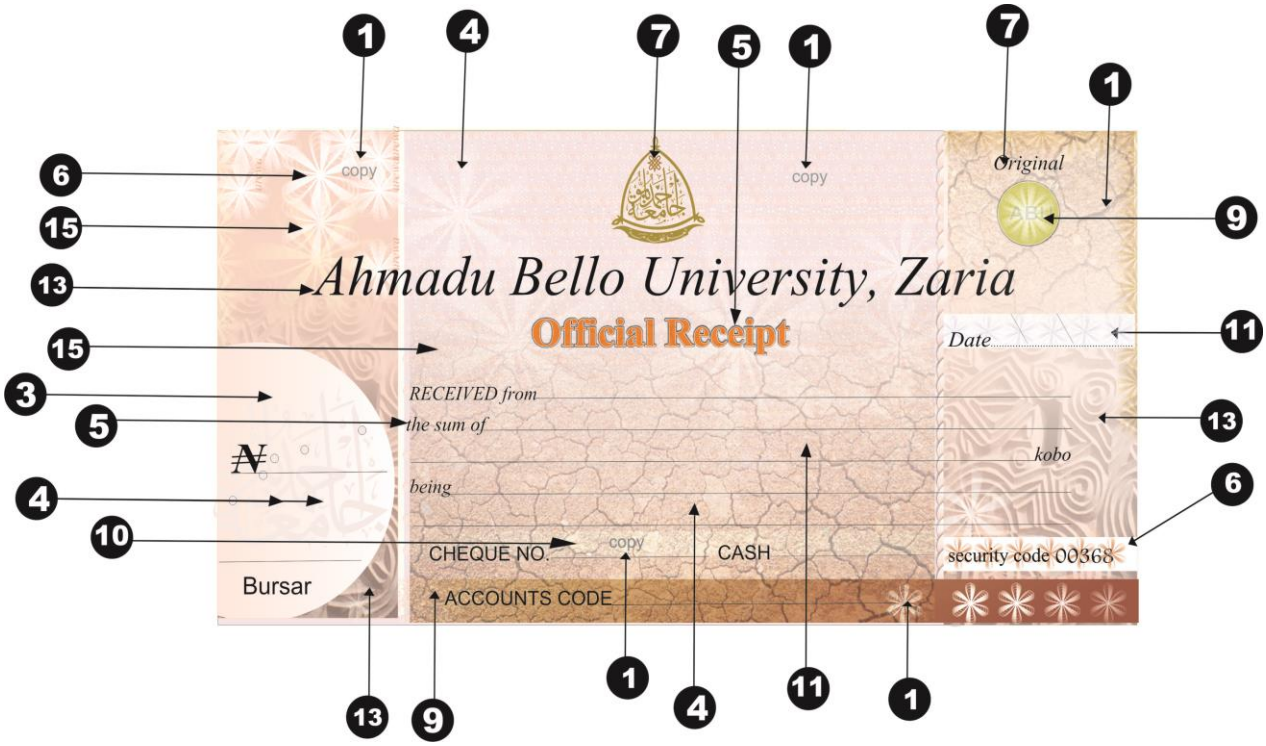


Plate 4: Redesigned Ahmadu Bello University Official Receipt

Source:-Hashim (2015)



Plate 5: Redesigned Ahmadu Bello University Student identity Card

Source:-Hashim (2015)

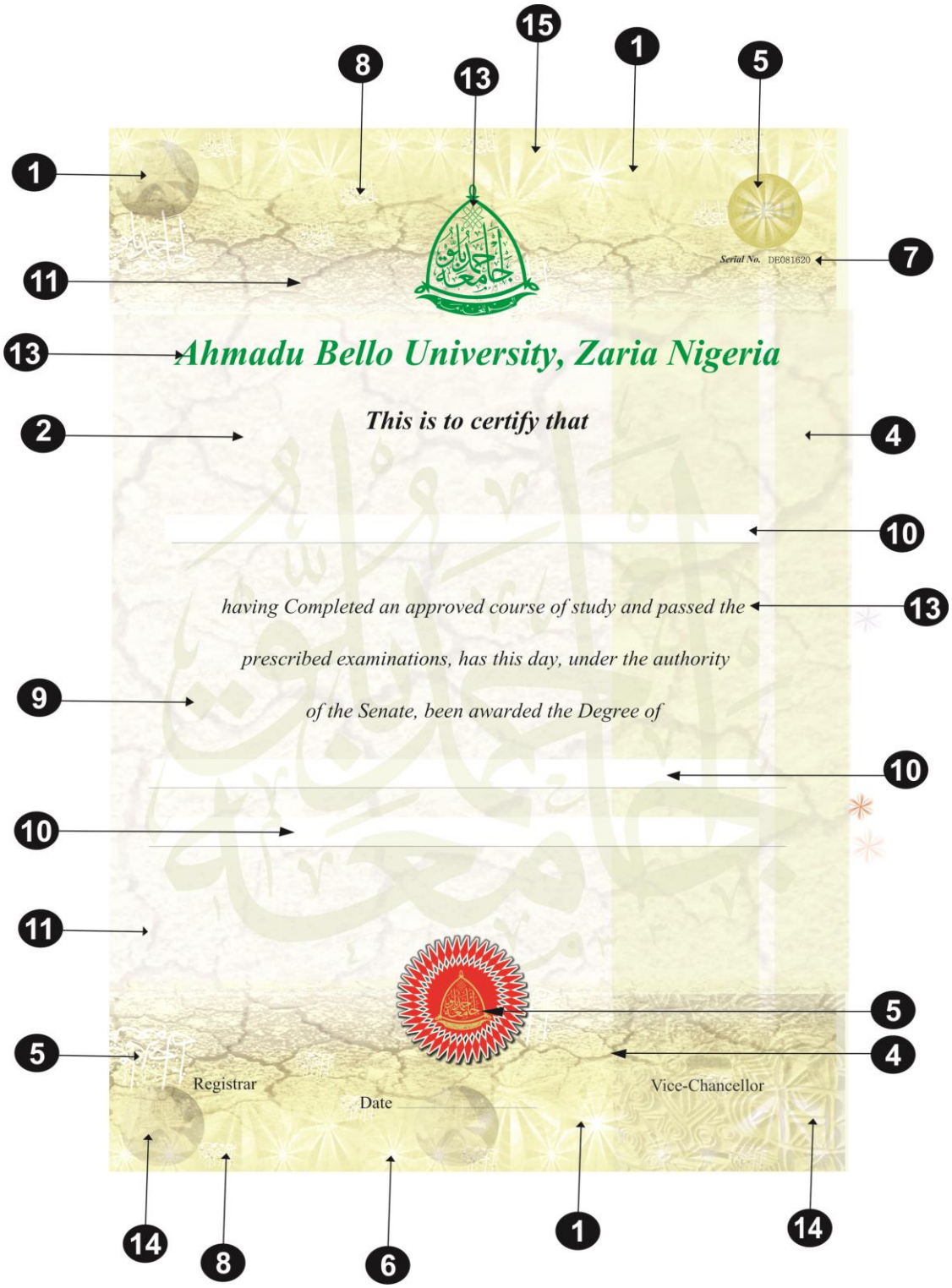
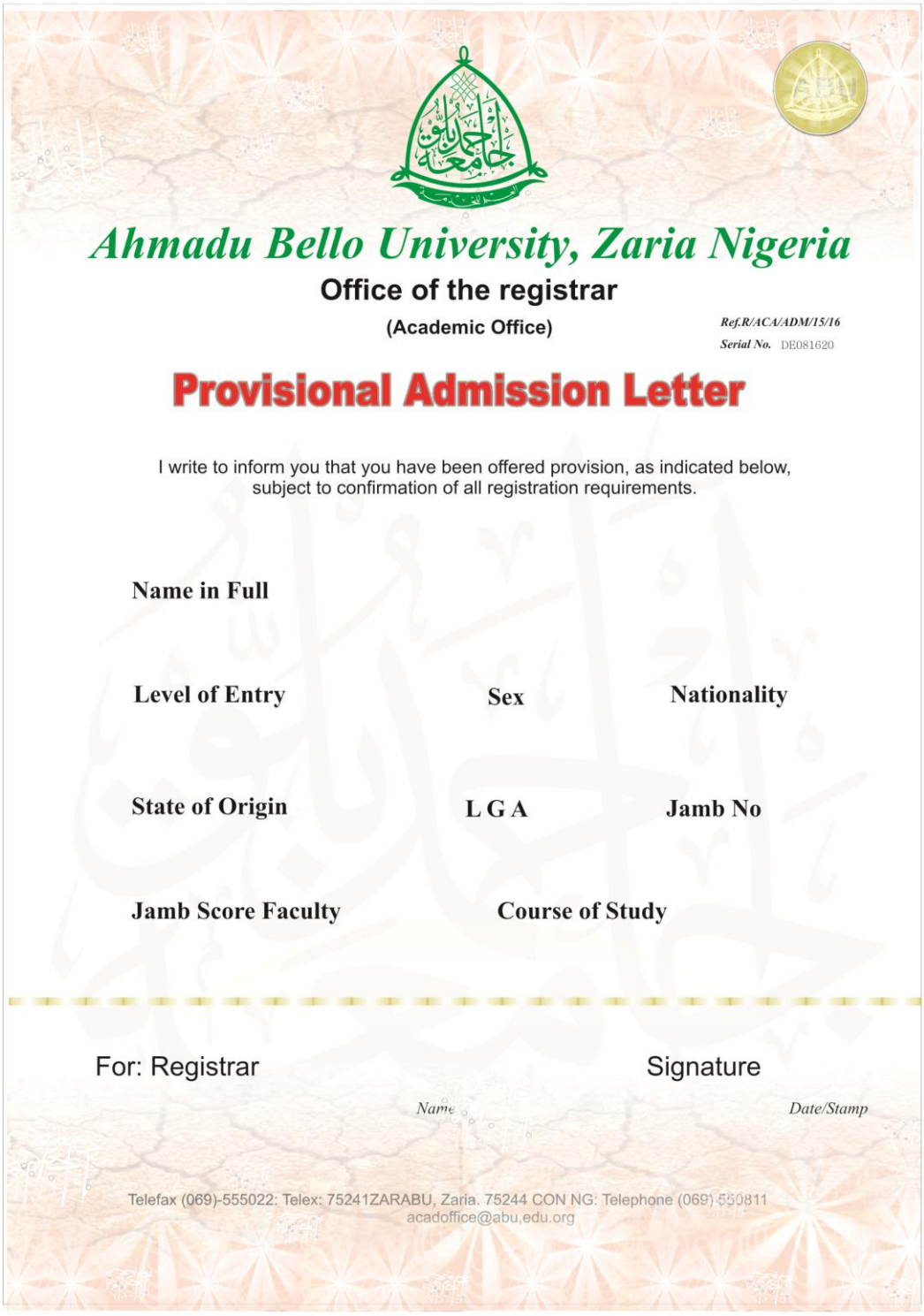


Plate 6: Redesigned Ahmadu Bello University Certificate

Source:-Hashim (2015)



Ahmadu Bello University, Zaria Nigeria

Office of the registrar

(Academic Office)

Ref.R/ACA/ADM/15/16

Serial No. DE081620

Provisional Admission Letter

I write to inform you that you have been offered provision, as indicated below, subject to confirmation of all registration requirements.

Name in Full

Level of Entry | Sex | Nationality

State of Origin | L G A | Jamb No

Jamb Score Faculty | Course of Study

For: Registrar | Signature

Name | Date/Stamp

Telefax (069)-555022: Telex: 75241ZARABU, Zaria. 75244 CON NG: Telephone (069) 550811
acadoffice@abu.edu.org

Plate 7: Redesigned Ahmadu Bello University Admission Letter

Source: -Hashim (2015)

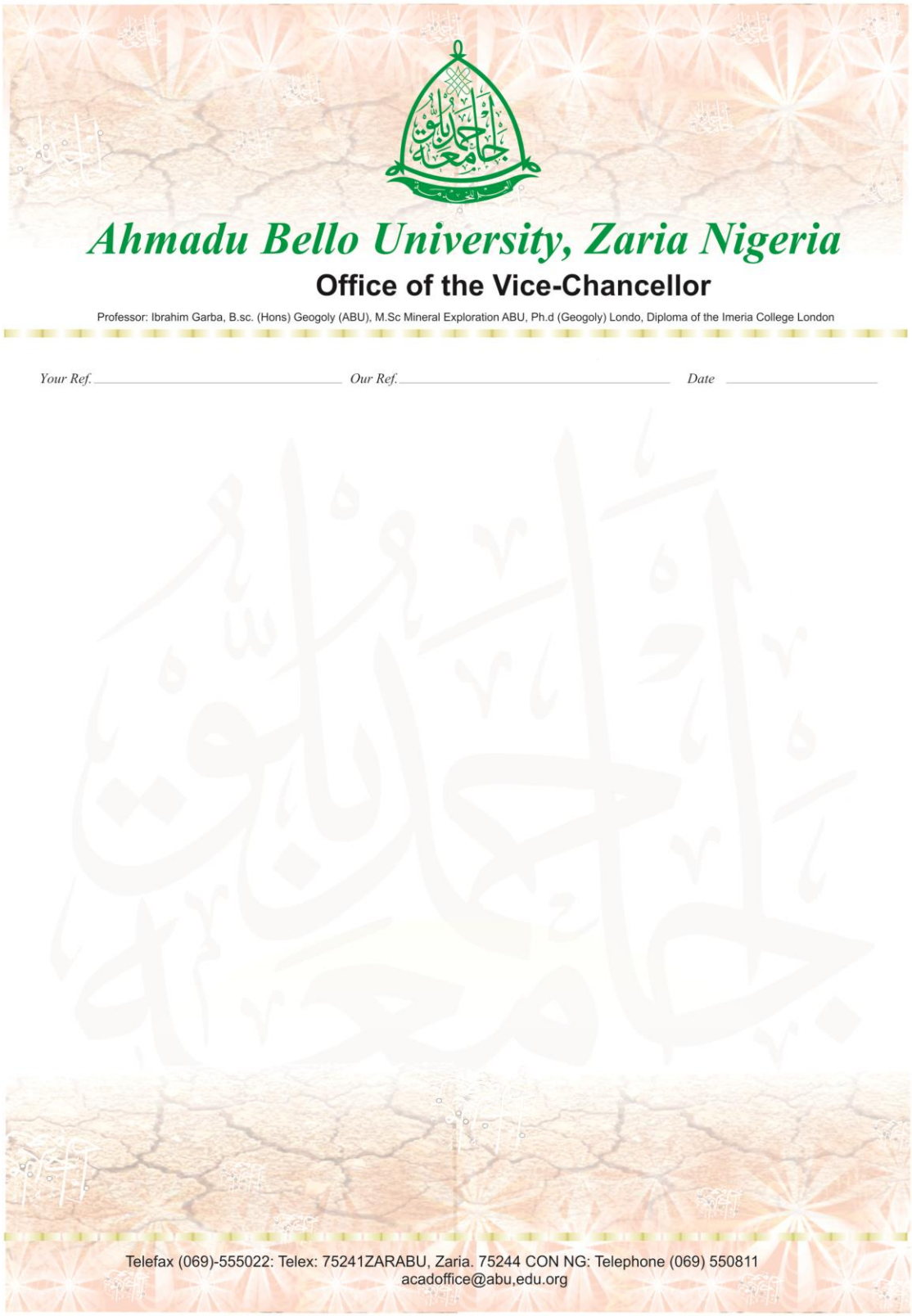


Plate 8: Redesigned Ahmadu Bello University Letter Head Paper

Source:-Hashim (2015)

The following are the adapted Banknote Security Features on the Redesigned Ahmadu Bello University sensitive documents

1. **Anti-copying Mark: -** This is an unnoticeable mark that is hidden in the design background and becomes very visible after scanned or copied.
2. **Bill paper.** This is a special security paper mostly used for printing banknote. In this case, the paper has the mixture of 73% rag (cotton) and 27% fibre (paper) woven with a special security feature embedded in it, during the paper making process.
3. **Chemically Reactive Paper**: This is special paper white in colour that changes from brownish colour to black when bleached solvents or any erasable chemicals are used on it in an attempt to alter the text.
4. **Ghost Watermark:** This is an artificial watermark created as a background during the paper making process.
5. **Colour Shifting Ink:** This is a special ink that changes to different rays of colours based on the angle that one holds the document.
6. **Invisible Ink:** This is special ink that is only visible under ultraviolet light**.**
7. **Penetrating Ink:** This is a unique ink that contains a penetrating red dye and goes into the fibres of the paper, and shows through to the back of the document to deter forgers from trying to scrape the number off the document.
8. **Micro-text:** This is a technique of creating very tiny and lighter repeated text that appears blurring as dotted line when copied or scanned.
9. **Fluorescent Coating:** This is an invisible ink, but glows under UV light/sensor.
10. **Erasable Ink:** This is a special ink that contains solvent chemical reactive substance, which rubs off when an attempt is made to alter the text written on it.
11. **High Resolution Image: -** This consists of very fine line/image that is too thin to reproduce illegally.

12. **Security Thread.** A security thread is an embedded security features into the valuable paper document, the thread with the text “ABU Zaria” embedded in it, and can clearly be seen when the document is held to a light source.
13. **Raised ink.** Raised ink is a special technique of security printing that one feels the raised ink on the text.
14. **Observe through Register:** This is a special technique that created small ABU logo printed both on the front (hollow) and back (filled up) on the document.
15. **Protection ornament: -** This is a special application of multifarious security features in the valuable paper document in the design process.

3.9.3 Experimental Stage

According to Mamza (2008), ‘Experimental research is the study of what is found when the investigator controls or manipulates certain variables being studied.’ After the collection and analysing of different banknote security features as well as the existing Ahmadu Bello University’s sensitive documents, the redesigning of some selected Ahmadu Bello University’s sensitive documents by introducing latest banknote security features was achieved. The redesigned of Ahmadu Bello University Zaria sensitive paper documents were critically assessed and authenticates through reliability test by the Professional graphic designers, printers and some of the lecturers in the Department of Industrial Design, Ahmadu Bello University Zaria.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0 Introduction

This chapter specifically presents the data collected from the fieldwork, as well as the analysis discussion of the data and description of the studio work. It follows the objectives of the study and carefully and highlights the result of each objective. At the same time this chapter presents the result of all the activities carried out to establish facts that have come to light through various investigations.

4.1 Procedure for Analyzing Data

Simple percentage and frequencies was used to analyze the data collected via the questionnaires. This method of data analysis appeared to be most suitable for analysis data collected for this study because it gave the researcher the leeway to first and foremost stockpile the data, calculate them and thereafter represent the results and distribute them in tables using simple percentages.

4.2 Response Rate

A total number of 49 copies of the questionnaire were distributed to the top five security printing companies in Nigeria, but only 42 copies of the questionnaire were duly completed, returned, examined, and found useful for analysis. This represents 85.7% response rate. Table 4.1 presents the distribution of the response rate.

Table 4.2: Response Rate from Questionnaires distributed to the top five security printing companies in Nigeria

S/N	Top five security printing companies in Nigeria	No. of Copies of Questionnaire Distributed		No. of Copies of Questionnaire Returned		Percentage of Questionnaire Copies Returned	
		Designers	**Printers**	**Designers**	**Printers**	**Designers**	**Printers**
1.	Nigerian Security Printing & Minting Company Plc, Lagos	8	2	8	1	**100%**	**50.0%**
2	Nigerian Security Printing & Minting Company Plc, Abuja	1	19	1	16	100%	84.2%
3	Euphoria Security Printing, Kaduna	3	3	2	3	66.6%	100%
4	Yaliam Press Abuja	4	5	3	5	75.0%	100%
5	Clear Impression Press, Kano	2	2	2	1	100%	50.0%
		18	**31**	**16**	**26**	100%	100%
	TOTAL	**49**		**42**		**88.3%**	**76.8%**

Table 4.3(a): **Research Question 1.** Professional Graphics Designers and Security Printers Opinions on the adaptation of Banknote security features on Ahmadu Bello University sensitive document

Can the Security features found in banknotes be adapted on Ahmadu Bello University sensitive documents?	**SA**		**A**		**U**		**SD**		**D**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	F	**%**	F	**%**
There are several security features and latest printing technologies found in banknotes that can be adapted on Ahmadu Bello University Sensitive documents for protection against counterfeiting.	22	52.4	18	42.9	0	0.0	0	0.0	2	4.7	42	100.0
Most of the valuable paper documents in Nigeria have little or no security features on them.	14	33.4	14	33.4	7	16.6	5	11.9	2	4.7	42	100.0

Keys: i) **SA** = Strongly Agree
ii) **A** = Agree
iii) **U** = Uncertain
iv) **D** = Disagree
v) **SD** = Strongly Disagree
vi) **F** = Frequency
vii) **%** Percentage

Table 4.3b: **Research Question 1.** Professional Graphics Designers and Security Printers Opinions on the adaptation of Banknote security features on Ahmadu Bello University sensitive document

How would the security features found in banknotes be adapted on Ahmadu Bello University sensitive documents?		YES		NO		TOTAL	
		F	%	F	%	F	%
The security documents produced by your organization has been forged in the area of	Ink	40	95.3	2	4.7	42	100.0
	Paper	38	90.5	4	9.4	42	100.0
	Design	33	78.6	9	13.9	42	100.0
	Paper	39	92.8	3	7.2	42	100.0
Do you think the menace of Forgery or Counterfeit of Ahmadu Bello University sensitive documents can be controlled through the following statements? Please tick as many as applicable.	Paper	38	90.4	4	9.6	42	100.0
	Design	37	88.1	5	11.9	42	100.0
	Printing Technique	35	83.4	7	16.6	42	100.0
	Ink	40	95.3	2	4.7	42	100.0
Which of the following Banknote security Component can easily be adapted on Ahmadu Bello University Sensitive documents for the protection against counterfeiting? Please tick as many as applicable.	Adaptation of Banknote security features on A B U Sensitive documents	36	85.7	6	14.3	42	100.0
	Reduced corruption Level	39	92.8	3	7.2	42	100.0
	Empowerment of youths	26	61.9	16	38.0	42	100.0
	Redefine Graphic design ethics.	40	95.2	2	4.8	42	100.0
	Arrest and immediate prosecution of fraudsters.	30	71.4	12	28.6	42	100.0
	Introduce security printing as a course in the Graphic design curriculum.	37	88.1	5	11.9	42	100.0
	Enlighten young/students about the consequences of such actions	16	38.1	26	61.9	42	100.0

4.3 Research Question 1

Can the security features found in banknotes be adapted on Ahmadu Bello University's sensitive documents?

Table 4.2 shows that 40 out of 42 respondents which represents 95.3% agree with the fact that security features and latest printing technologies found in banknotes can be adapted on Ahmadu Bello University's Sensitive documents for protection against counterfeiting, while only 02 out of 42 respondents which represents 4.7% disagree with this fact. This is in line with the findings of Dakyes (2009) who opined that there are so many paper security components, but they can be classified into four basic areas: Ink, paper, design and printing process. Additionally, Giesecke & Devrient (2008) points that security printing requires a high degree of specialization, and innovative in-house technologies for all its security printing solutions from ink and paper to printing processes, security features, and authentication procedures.

Secondly, 38 out of 42 respondents which represent 90% agree with the fact that most of the valuable paper documents in Nigeria have little or no security features on them. 95.3 % of the respondents attested to the fact that the security documents produced by their organizations are mostly forged in the areas of ink, paper, printing techniques and design.

At the same time, 95.3% of the respondents agreed with the fact that the following banknotes security Components; Printing ink, paper, printing techniques and banknotes design can easily be adapted on Ahmadu Bello University's sensitive documents for protection against counterfeiting. Finally, 76% of the respondents believe that, the menace of forgery and counterfeit of Ahmadu Bello University's sensitive documents can be drastically minimized through the following; Adaptation of Banknote security features on Ahmadu Bello University's sensitive documents, reduced corruption level, youth empowerment, introduction of security printing as a course in the graphic design curriculum

Table 4.4a: **Research Question 2.** Professional Graphics Designers and Security Printers Opinions on the adaptation of Banknote security features on Ahmadu Bello University sensitive document

How would Ahmadu Bello University sensitive documents be redesigned by introducing multifarious security features on them?	**SA**		**A**		**U**		**SD**		**D**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	F	**%**	F	**%**
Redesigning Ahmadu Bello University Sensitive documents by adapting complex security features of banknote that can protect them against forgery and counterfeiting	25	59.5	16	38.1	0	0.0	1	2.4	0	0.0	42	100.0
Reprinting Ahmadu Bello University Sensitive documents with non-commercially available security ink will protect them against counterfeiting.	30	71.4	11	26.2	0	0.0	00	0.0	1	2.4	42	100.0
Most of the valuable paper documents in Nigeria are printed by security printing companies?	2	4.7	4	9.6	5	11.9	14	33.3	17	40.4	42	100.0

Table 4.4(b): **Research Question 2.** Professional Graphics Designers and Security Printers Opinions on the adaptation of Banknote security features on Ahmadu Bello University sensitive document

		YES		NO		TOTAL	
How would Ahmadu Bello University sensitive documents be redesigned by introducing multifarious security features on them'		F	%	F	%	F	%
Have your design or prints ever been forged or counterfeited by fraudsters?		16	38.1	26	61.9	42	100.0
The following Printing techniques are mostly used by Nigerian fraudsters Please tick as many as applicable	Scanning	39	92.8	3	7.2	42	100.0
	Re-design	38	90.4	4	9.6	42	100.0
	Copying	37	88.1	5	11.9	42	100.0
	Altering	35	83.4	7	16.6	42	100.0

4.4 Research Question 2

How would Ahmadu Bello University sensitive documents be redesigned by introducing multifarious security features on them?

Table 4.3 shows that 97.6 % of the respondents agree with the fact that redesigning Ahmadu Bello University Sensitive documents by introducing multifarious security features on them can protect them against forgery and counterfeiting.

Secondly, 41 out of 42 respondents, which represents 97.6 % agree that reprinting Ahmadu Bello University's Sensitive documents with non-commercially available security ink will protect them against counterfeiting, while only 01 out of 42 respondents, which represent 2.4% is uncertain about the question.

However, majority of the respondents agree that most of the valuable paper documents in Nigeria have little or no security features on them.

Additionally, only 38.1 % of the respondents agree that their designing or printing have ever been Forged or Counterfeited by fraudsters, while 61.9% of the respondents disagreed with the statement.

Finally, 86% of the respondents acknowledged that the following Printing techniques are mostly used by Nigerian fraudsters: scanning, re-design, copying and altering.

Table 4.5 (a) Research Question 3 Professional Graphics Designers and Security Printers Opinions on the adaptation of Banknote security features on Ahmadu Bello University sensitive document

In what ways could reliability test be carried out on the adopted security features on Ahmadu Bello University's sensitive documents?		**SA**		**A**		**U**		**SD**		**D**		**Total**	
		F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	F	**%**	F	**%**
Which of the following banknote security component (Design) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting	Micro Text	8	19.0	27	64.3	3	7.1	0	0.0	4	9.2	42	100.0
	Anti-copying mark	22	52.3	15	35.7	5	11.9	0	0.0	2	4.7	42	100.0
	High resolution image	20	47.6	16	39.1	3	7.1	1	2.3	2	4.7	42	100.0
Which of the following banknote security component (Paper) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting	Water mark	8	19.0	27	64.2	3	7.1	0	0.0	4	9.6	42	100.0
	Bill Paper	20	47.7	17	40.5	3	7.1	0	0.0	2	4.7	42	100.0
	Chemically Reacted Paper	11	26.3	23	54.8	2	4.7	2	4.7	4	9.5	42	100.0
Which of the following banknote security component (Ink) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting	Fluorescent ink	16	38.1	20	47.7	4	9.5	1	2.3	1	2.3	42	100.0
	Penetrating ink	5	11.9	21	50.0	7	16.7	4	9.5	5	11.9	42	100.0
	Invisible ink	23	54.8	17	40.5	0	00	0	0.0	2	4.7	42	100.0
Which of the following banknote security component (Printing technique) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting	Observe Through	5	11.9	7	16.7	10	23.9	17	40.4	3	7.1	42	100.0
	Raised Ink	9	21.3	26	62.0	2	4.7	2	4.7	3	7.1	42	100.0

Table 4.5 (b) Research Question 3. Professional Graphics Designers and Security Printers Opinions on the adaptation of Banknote security features on Ahmadu Bello University sensitive document

In what ways could reliability test be carried out on the adopted security features on Ahmadu Bello University's sensitive documents?	YES		NO		TOTAL	
	F	%	F	%	F	%
Do you think the adopted banknote security features on the redesigned Ahmadu Bello University's sensitive documents can be applicable to other valuable paper documents within and outside the university for protect against counterfeiting	40	95.2	2	4.8	42	100.0

4.5 Research Question 3

In what ways could reliability test be carried out on the adapted security features on Ahmadu Bello University's sensitive documents?

Table 4.4 shows that 37 out of 42 respondents which represent 88 % of the respondents agreed with the fact that banknote security features (anti-copying mark) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting. Moreover, 37 and 34 out of 42 respondents which represent 87% and 81% respectively agree with the fact that banknote security features (bill paper and chemically reacted paper) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting.

Additionally, 40 out of 42 respondents which represent 95.3% agree with the fact that that non-commercially available ink, invisible ink; florescent ink; penetrating ink as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting, while only 02 out of 42 respondents which represents 4.7% disagreed with this fact.

Finally, 40 out of 42 respondents, which represent 95.3% agree with the statement that the adopted banknote security features on the redesigned Ahmadu Bello University's sensitive documents can be applicable to other valuable paper documents within and outside the university for protecting against counterfeiting, while only 02 out of 42 respondents which represent 4.7% disagreed with this statement.

Table 4.6: **Research Question 4.** Professional Graphics Designers and Security Printers Opinions on the adaptation of Banknote security features on Ahmadu Bello University sensitive document

How could a body of knowledge in the area of security printing and paper document protection be developed?	**SA**		**A**		**U**		**SD**		**D**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	F	**%**	F	**%**
Could this research constitute a first step document towards developing our own indigenous security printing technology and open up further research and development (R & D) endeavours.	16	38.1	20	47.7	4	9.5	1	2.4	1	2.3	42	100.0
Could this research constitute a number of additional literatures for research purpose?	21	50.0	11	26.2	0	0.0	2	4.7	8	19.1	42	100.0
Could the finding of this study serves as a reference point for researchers, practicing graphic designers, printers, design and students	31	73.8	5	11.9	0	0.0	2	4.8	4	9.6	42	100.0
Could the Knowledge of security printing methods and materials (paper, ink, Design and printing techniques) have great relevance in the area of paper document protection?	28	66.6	7	16.6	2	4.7	2	4.7	3	7.2	42	100.0
Could the identified problems of this study advance the frontiers of Knowledge in the area of security printing, forgery, counterfeit, document theft and paper document protection?	20	47.6	14	33.3	1	2.4	2	4.7	5	11.9	42	100.0

4.6 Research Question 4

How could a body of knowledge in the area of security printing and paper document protection be developed?

Table 4.5 shows that 36 out of 42 respondents, which represent 85.6 % of the respondents agreed with the fact that this research constitute a first step document towards developing our own indigenous security printing technology and open up further research and development (R & D) endeavours.

Secondly, it shows that 32 out of 42 respondents, which represent 76.2 % of the respondents, agree with the fact that this study will contribute to the number of literature available for research purpose. Moreover, 36 out of 42 respondents, which represent 85.7 % of the respondents, agree with the fact that the finding of this study will serve as a reference point for researchers, practicing graphic designers, printers and design students. Furthermore, 35 out of 42 respondents, which represent 83.3 % of the respondents agreed with the fact that the identifiable problems of this study will advanced the frontiers of Knowledge in the area of security printing, forgery, counterfeit, corruption, document theft and paper document protection.

Finally, 35 out of 42 respondents, which represent 83.3 % of the respondents, agree with the fact that Knowledge of printing ink, paper, printing process and security printing has great relevance in the area of security printing and paper protection. This is in line with Giesecke & Devrient (2008), who notes that security printing requires a high degree of specialization, and innovative in-house technologies.

4.7 Major Findings

This section discussed the major findings of the study from the data gathered during the pre and post tests conducted from top five excellent security companies in Lagos, Abuja, Kaduna and Kano, Nigeria. Additionally, other respondents that participated in the study

were the Chief Security Officer, Ahmadu Bello University, Zaria, lecturers from Department of Industrial Design, Ahmadu Bello University, Zaria. Through the structured questionnaire and the following findings were made.

1. This study revealed that there are several banknote security features and latest printing technologies that can be adapted on Ahmadu Bello University's sensitive documents for protection against forgery and counterfeiting.
2. This study revealed that redesigning Ahmadu Bello University's sensitive documents by introducing complex security features on them will minimize the menace of forgery and counterfeiting.
3. This study revealed that most of the Ahmadu Bello University's valuable paper documents have little or no security features on them.
4. This study revealed that banknote remains the most secured valuable paper document all over the world; therefore, adaptation of banknote security features on Ahmadu Bello University's sensitive documents will surely minimize the menace of forgery and counterfeiting in Nigeria.
5. This study revealed that there are serious needs for the graphics designers and printers to have insight knowledge of security printing component which are ink, paper, design and printing process in order to protect our valuable paper documents from the menace of forgery and counterfeiting.
6. Finally, the study revealed that this study constitute a first step document towards developing our own indigenous security printing technology and open up further research and development (R & D) endeavours. At the same time this study will serve as a reference point for researchers, practicing graphic designers, printers, design students and so on.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter summarises the entire research, conclusion and recommendations based on the research findings. It also advances some suggestions for further research.

This study focused on the Adaptation of Banknote Security Features on Some Ahmadu Bello University's Sensitive Documents for Protection against Counterfeiting. In order to carry out this research, four research questions were formulated. The research sought to find out how banknote security features can be adapted on Ahmadu Bello University's sensitive documents, and how Ahmadu Bello University sensitive documents could be redesigned by introducing multifarious security features on them. Experimental research was design employed for the study. The population of this study comprised the following:

- Ahmadu Bello University sensitive documents
- Latest security features and materials found on the banknotes and other secured paper documents
- Professional graphic designers and printers working in security printing companies in Nigeria

The researcher used purposive sampling technique to select 15 out of over 87 different banknotes security features globally. The total number of 49 copies of the questionnaire was distributed to the top five security printing companies in Nigeria, but only 42 copies of the questionnaire were duly completed, returned, examined, and found useful for analysis. This represents 85.7% response rate.

5.1 Summary of Major Findings

From the findings of this study, it was revealed that forgery and counterfeiting are motivated by the following factors: greed, bribery and corruption, financial gain, intellectual

pursuit, low rate of conviction, frustration. Moreover, the study established a fact that unemployment, corruption, poverty, peer group influence, easy accessibility to the computer and graphic design soft wares aid the menaces of forgery and counterfeit in Nigeria.

Furthermore, the findings revealed that forgery and counterfeiting have negative consequences which range from tarnishing the country's reputation nationally and internationally, to lack of trust and confidence, denial of innocent Nigerians certain opportunities abroad and loss of employment.

It was admitted that forgery and counterfeiting cannot be totally eradicated, but it can be minimized if the following actions are implemented; zero tolerance to corruption, students/youth empowerment by creating jobs, enlightening young ones about the consequences of such acts under the law, arresting and immediate prosecution of the fraudsters, redefining our ethical standards from acquiring wealth at all costs to other cherished values, and finally, introducing a courses on security printing and paper document protection in our curriculum for graphics design students.

5.2 Discussion of Key Findings

This section discusses the key findings from this research in relation to other scholar's findings. As to the Adaptation of Banknote Security features on some Ahmadu Bello University's sensitive documents for protection against counterfeiting, Awe (2009) states that 'widespread of corruption, harsh economic climate, high unemployment, disregard for the rule of law and lack of transparency and accountability in governance are the main causes of criminal activities in Nigeria''. President Muhammadu Buhari (2015) supported the idea by saying "if Nigeria does not kill corruption, corruption will kill Nigeria."

The study revealed that students/youths in tertiary institutions and graduates seeking for admission/employment are mostly the perpetrators of this criminal activity, this finding is in consonance with the findings of EFCC (2012) notes that 'students and unemployed

graduates as the main perpetrators of the criminal activities in Nigeria. For example, a 25-year-old student of the University of Ilorin, Imonina Kingsley, was accused of impersonation, possession of fraudulent documents and attempt to obtain money by false pretences and was sentenced to 20 year jail term (Adeta 2014)

5.3 Conclusion

The advent of computer and direct imaging system make forgery and counterfeiting easier and more rampant. This study revealed that printing techniques such as; scanning, alteration and reprinting are mostly used in forging and counterfeiting valuable paper documents that have little or no security features on them by Nigerian fraudsters. Furthermore, most of the paper documents produced by Nigerian Security Printing Companies are counterfeited or forged in the area of ink and paper. Additionally, Banknote remains the most secured paper document all over the world, therefore the following banknote security components such as; secured paper, non-commercially available ink, complicated design and latest printing techniques can be adapted on Ahmadu Bello University's Sensitive documents for protection against forgery and counterfeiting.

Moreover, the prevalence of bribery and corruption, unemployment and lapses in efforts from governmental and non-governmental organisations contributed to the menace of forgery and counterfeiting in Nigeria. Pitiably, in a society like Nigeria where more emphasis is placed on paper qualification rather than capability, the frequency of forgery and counterfeit in Nigeria will continue to escalate, therefore, the need for a formidable security printing professional body that will regulate its activities is very necessary in curbing the menace of forgery and counterfeiting in Nigeria.

5.4 Recommendations

The recommendations for this research are proffered based on major findings of the study.

The recommendations are as follows:

It is recommended that banknote security features and latest printing technologies as adapted on some redesigned Ahmadu Bello University's sensitive documents can be employed for the protection of other valuable paper documents; this will surely help to minimize the menace of forgery and counterfeiting in Nigeria as a whole.

It is a fact that banknote remains the most secured valuable paper document all over the world; therefore, there are several security features and latest printing technologies found on banknote that can be adapted for paper documents for protection against forgery and counterfeiting in Nigeria.

It was recommended that this study will serve as a reference point for researchers, practicing graphic designers, printers and design students because it constitutes a first step document towards developing our own indigenous security printing technology and open up further research and development (R & D) endeavours.

It was recommended that graphic designers, researchers, indigenous ink producers, in-house paper mill companies and security printing companies should jointly tackle the ugly phenomenon of forgery and counterfeiting for Nigeria to move forward.

It is recommended that hence forward, all design and printing of valuable paper documents from both governmental and non-governmental organisations should be handed by professional security printing companies only.

It was recommended that hence forward, both governmental and non-governmental organisations should lay more emphasis on capability rather than on paper qualification when

recruiting. This will significantly minimise the menace of forgery and counterfeit of valuable paper documents in Nigeria.

Finally, a courses on forgery and counterfeiting, piracy, faking, documents theft, and security printing component such as production of secured ink production, paper making process, intricate and ornamented security design and latest printing process should be introduced in graphic designers' curriculum to take care of the present technological development.

5.5 Contributions to Knowledge

The study established that:

i. The study of document protection security features that was hitherto exclusive preserve of authorized banknote producers can be carried out by graphic designers.

ii. Banknote security features that were exclusively used on banknote can be used to protect other sensitive documents.

iii. The knowledge of document protection features by end users is crucial in curtailing sensitive document theft.

5.6 Suggestions for further research

Based on the findings and conclusion of this study, the following areas were suggested for further research.

1. Development of indigenous printing ink (Non-commercial availably ink) by the use of locally available substances for the protection of valuable paper documents against forgery and counterfeiting in Nigeria.

2. Embedding of indigenous motifs as a Watermark for the protection of valuable paper documents in Nigeria against forgery and counterfeiting.

3. Generating of indigenous security components for the protection of valuable paper documents against forgery and counterfeiting in Nigeria.
4. Development of secured Bill Paper (Non-commercial availably ink) using of locally available materials for the protection of valuable paper documents against counterfeiting in Nigeria.
5. Generating of indigenous security features for the protection of Ahmadu Bello University's valuable paper documents against forgery and counterfeiting in Nigeria.

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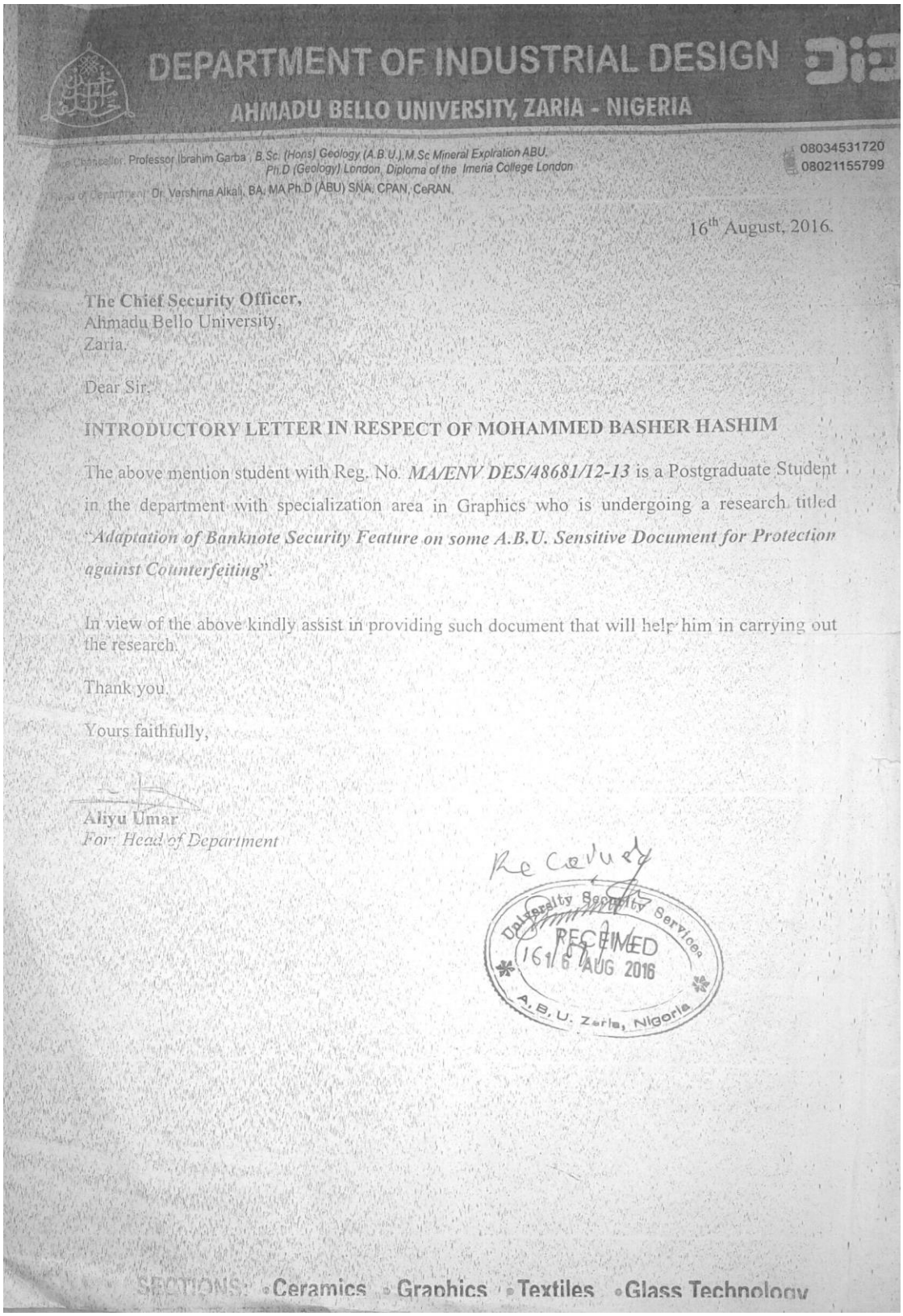
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APPENDIX 1

Letter of Introduction



DEPARTMENT OF INDUSTRIAL DESIGN

AHMADU BELLO UNIVERSITY, ZARIA - NIGERIA

Vice Chancellor: Professor Ibrahim Garba, B.Sc. (Hons) Geology (A.B.U.), M.Sc Mineral Exploration ABU, Ph.D (Geology) London, Diploma of the Imeria College London

Head of Department: Dr. Vershima Alkali, BA, MA Ph.D (ABU) SNA, CPAN, CeRAN

08034531720
08021155799

16th August, 2016.

The Chief Security Officer,
Ahmadu Bello University,
Zaria.

Dear Sir,

INTRODUCTORY LETTER IN RESPECT OF MOHAMMED BASHER HASHIM

The above mention student with Reg. No. *MA/ENV DES/48681/12-13* is a Postgraduate Student in the department with specialization area in Graphics who is undergoing a research titled "*Adaptation of Banknote Security Feature on some A.B.U. Sensitive Document for Protection against Counterfeiting*".

In view of the above kindly assist in providing such document that will help him in carrying out the research.

Thank you.

Yours faithfully,

Aliyu Umar
For: Head of Department

Re Cleared

University Security Services
RECEIVED
16/8 AUG 2016
A.B.U. Zaria, Nigeria

SECTIONS: • Ceramics • Graphics • Textiles • Glass Technology

APPENDIX 2

Questionnaire for Professional Graphic Designers and Printers

(Working in Security Printing Companies in Nigeria)

Dear Respondent,

I am a Masters student of the Department of Industrial Design, Ahmadu Bello University, Zaria. I am undertaking a research work on **ADAPTATION OF BANKNOTE SECURITY FEATURES ON SOME AHMADU BELLO UNIVERSITY SENSITIVE DOCUMENTS FOR PROTECTION AGAINST COUNTERFEITING.**

The research is part of the requirement for the award of M.A. Industrial Design (Graphics) in the Department of Industrial Design. Your consent and responses are strictly for academic purposes and will be treated with absolute confidentiality.

SECTION: A – Personal's Data (Optional)

1. Name……
   ……
2. Organization……
   ……
3. Gender:- M ☐ F ☐
4. Age: 18 – 25 ☐ 26 – 35 ☐ 36 – 45 ☐ ___ve 45 ☐
5. Marital Status:- Single ☐ Married ☐
6. How long have you been practicing as a graphic designer

0 – 5 Years ☐ 6 – 10 Years 11 – 15 Years ☐ above 15 years ☐

7. What is your field of study /Discipline? Designer ☐ Printer ☐
8. Level of Education/ Qualification

- Primary …… ☐
- Secondary …… ☐
- Diploma/ HND ……... ☐
- N C E…… ☐
- University Graduate……. ☐
- Post Graduate …… ☐

SECTION: B

Guide Line:- Please tick (√) the option you think is the most appropriate in the box provided for each question. By using this Keys i) Strongly Agree = SA ii) Agree = A iii) Uncertain = U iv) Disagree = D v) Strongly Disagree as appropriate. All information will be treated with utmost confidentiality and will strictly be used for the purpose of research only.

S/N	Questions		SA	A	U	S	SD
1	There are several security features and latest printing technologies found in banknotes that can be adapted on Ahmadu Bello University Sensitive documents for protection against counterfeiting.						
2	Most of the valuable paper documents in Nigeria have little or no security features on them?						
3	Redesigning Ahmadu Bello University Sensitive documents by introducing complex security features can protect them against counterfeiting						
4	Reprinting Ahmadu Bello University Sensitive documents with non-commercially available security ink will protect them against counterfeiting.						
5	Most of the valuable paper documents in Nigeria are printed by security printing companies.						
6	The Knowledge of security printing methods and materials (paper, ink, Design and printing techniques) has great relevance to the area of paper document protection.						
7	Adaptation of banknote security features on sensitive documents can minimise menaces of forgery and counterfeiters in Nigeria.						
8	Which of the following banknote security component (Design) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting	Micro Text					
		Anti copying mark					
		High resolution image					
9	Which of the following banknote security component (Paper) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting	Water mark					
		Bill Paper					
		Chemically Reacted Paper					

S/N	Questions		SA	A	U	S	SD
10	Which of the following banknote security component (Ink) as adapted on the redesigned Ahmadu Bello University's sensitive documents can protect them against forgery and counterfeiting	Fluorescent ink					
		Penetrating ink					
		Invisible ink					
11	Which of the following banknote security component (Printing technique) as adapted on the redesigned Ahmadu Bello University's sensitive						
		Observe Through					
		Raised Ink					
12	Could this research constitute a first step document towards developing our own indigenous security printing technology and open up further research and development (R & D) endeavours.						
13	Could this research report will contribute to the number of literature available for research purpose.						
14	The finding of this study will serve as reference point for researchers, practicing graphic designers, printers, design students and so on.						
15	The identifiable problems of this study will advanced the frontiers of Knowledge in the area of security printing, forgery, counterfeit, corruption, document theft and paper document protection.						

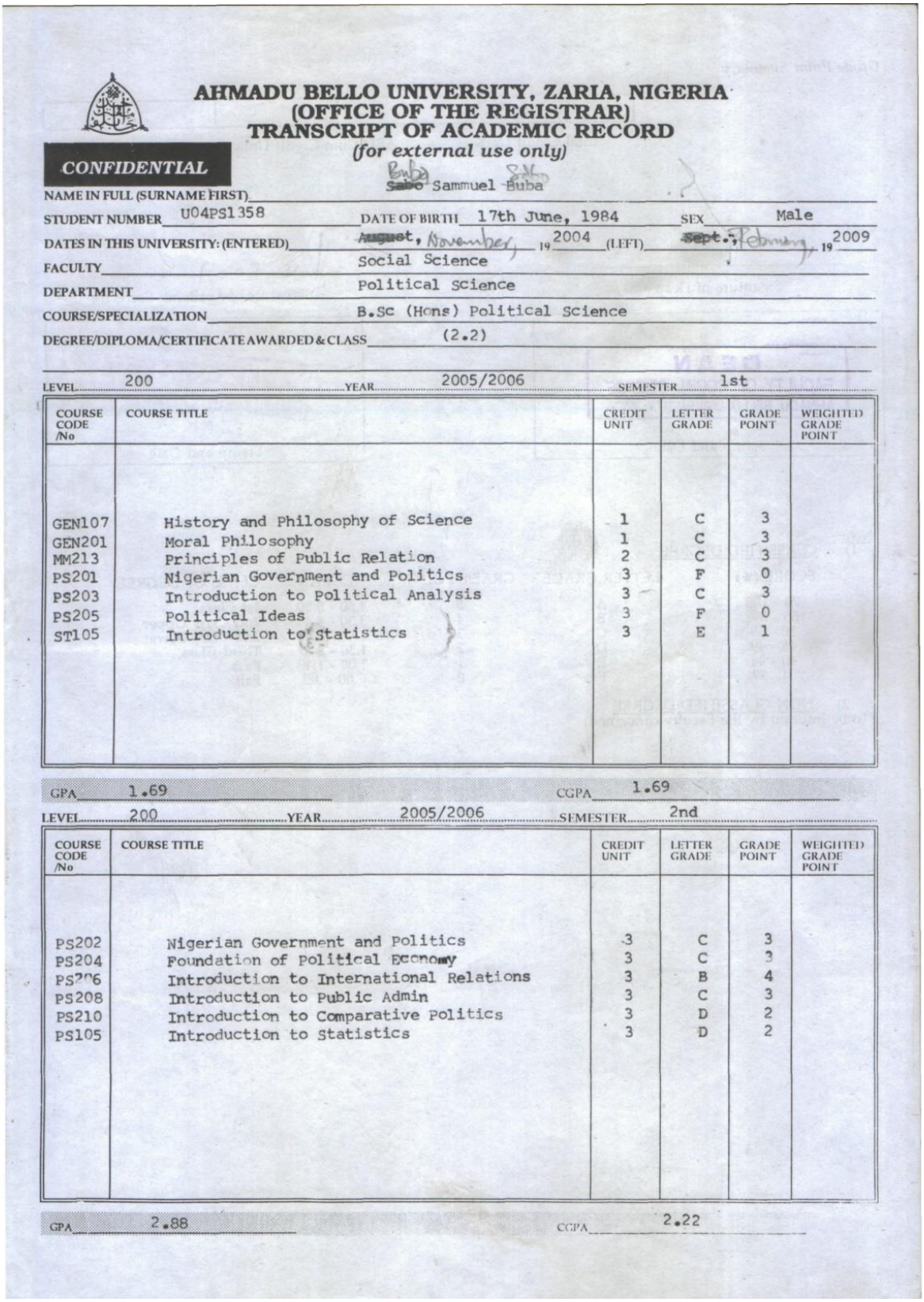
SECTION: C

Guide Line:- Please tick (√) the option you think is the most appropriate in the box provided by either ticking **YES or NO.**

S/N	Questions		Yes	No
16	The security documents produced by your organization had forget in the area of			
		Ink		
		Paper		
		Design		
		Security Feature		
17	Which of the following Banknote security Component can easily be adapted on Ahmadu Bello University Sensitive documents for the protection against counterfeiting? Please tick as many as apply.			
		Paper		
		Ink		
		Design		
		Printing Technique		
18	Do your designing or printing ever been Forged or Counterfeited by fraudsters?			
19	The following Printing techniques are mostly used by Nigerian fraudsters Please tick as many as apply			
		Scanning		
		Re-design		
		Copying		
		Altering		
20	Do you think the adopted banknote security features on the redesigned Ahmadu Bello University's sensitive documents can be applicable to other valuable paper documents within and outside the university for protect against counterfeiting			

APPENDIX 3

Forged Ahmadu Bello University Transcript of Academic Records



AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA
(OFFICE OF THE REGISTRAR)
TRANSCRIPT OF ACADEMIC RECORD
(for external use only)

CONFIDENTIAL

NAME IN FULL (SURNAME FIRST) ~~Saibo~~ Sammuel Buba

STUDENT NUMBER U04PS1358 DATE OF BIRTH 17th June, 1984 SEX Male

DATES IN THIS UNIVERSITY: (ENTERED) ~~August~~, November 19 2004 (LEFT) ~~Sept.~~, February 19 2009

FACULTY Social Science

DEPARTMENT Political Science

COURSE/SPECIALIZATION B.Sc (Hons) Political Science

DEGREE/DIPLOMA/CERTIFICATE AWARDED & CLASS (2.2)

LEVEL 200 YEAR 2005/2006 SEMESTER 1st

COURSE CODE /No	COURSE TITLE	CREDIT UNIT	LETTER GRADE	GRADE POINT	WEIGHTED GRADE POINT
GEN107	History and Philosophy of Science	1	C	3	
GEN201	Moral Philosophy	1	C	3	
MM213	Principles of Public Relation	2	C	3	
PS201	Nigerian Government and Politics	3	F	0	
PS203	Introduction to Political Analysis	3	C	3	
PS205	Political Ideas	3	F	0	
ST105	Introduction to Statistics	3	E	1	

GPA 1.69 CGPA 1.69

LEVEL 200 YEAR 2005/2006 SEMESTER 2nd

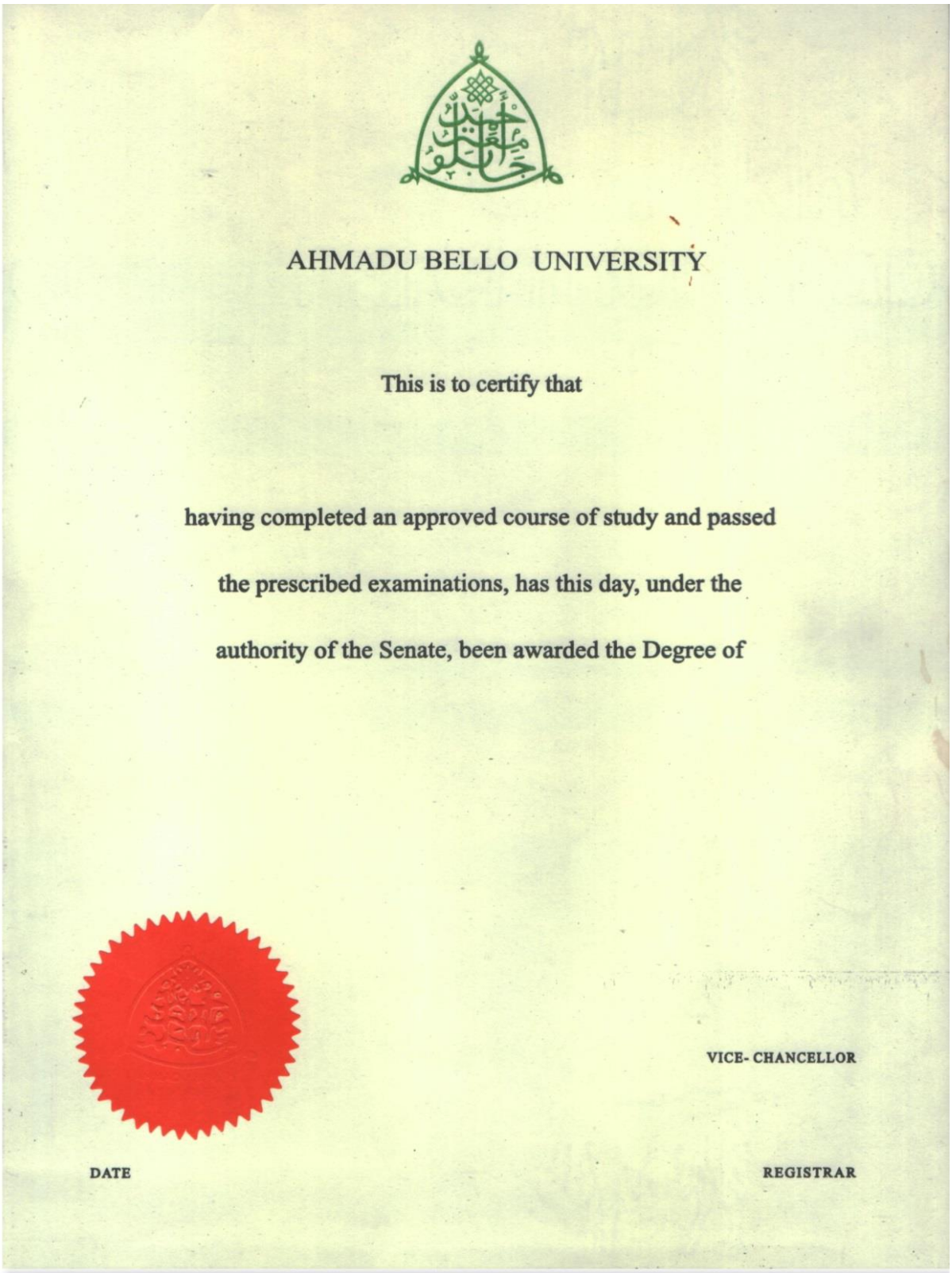
COURSE CODE /No	COURSE TITLE	CREDIT UNIT	LETTER GRADE	GRADE POINT	WEIGHTED GRADE POINT
PS202	Nigerian Government and Politics	3	C	3	
PS204	Foundation of Political Economy	3	C	3	
PS206	Introduction to International Relations	3	B	4	
PS208	Introduction to Public Admin	3	C	3	
PS210	Introduction to Comparative Politics	3	D	2	
PS105	Introduction to Statistics	3	D	2	

GPA 2.88 CGPA 2.22

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 4

Counterfeited Ahmadu Bello University Undergraduate Certificate



AHMADU BELLO UNIVERSITY

This is to certify that

having completed an approved course of study and passed the prescribed examinations, has this day, under the authority of the Senate, been awarded the Degree of

VICE- CHANCELLOR

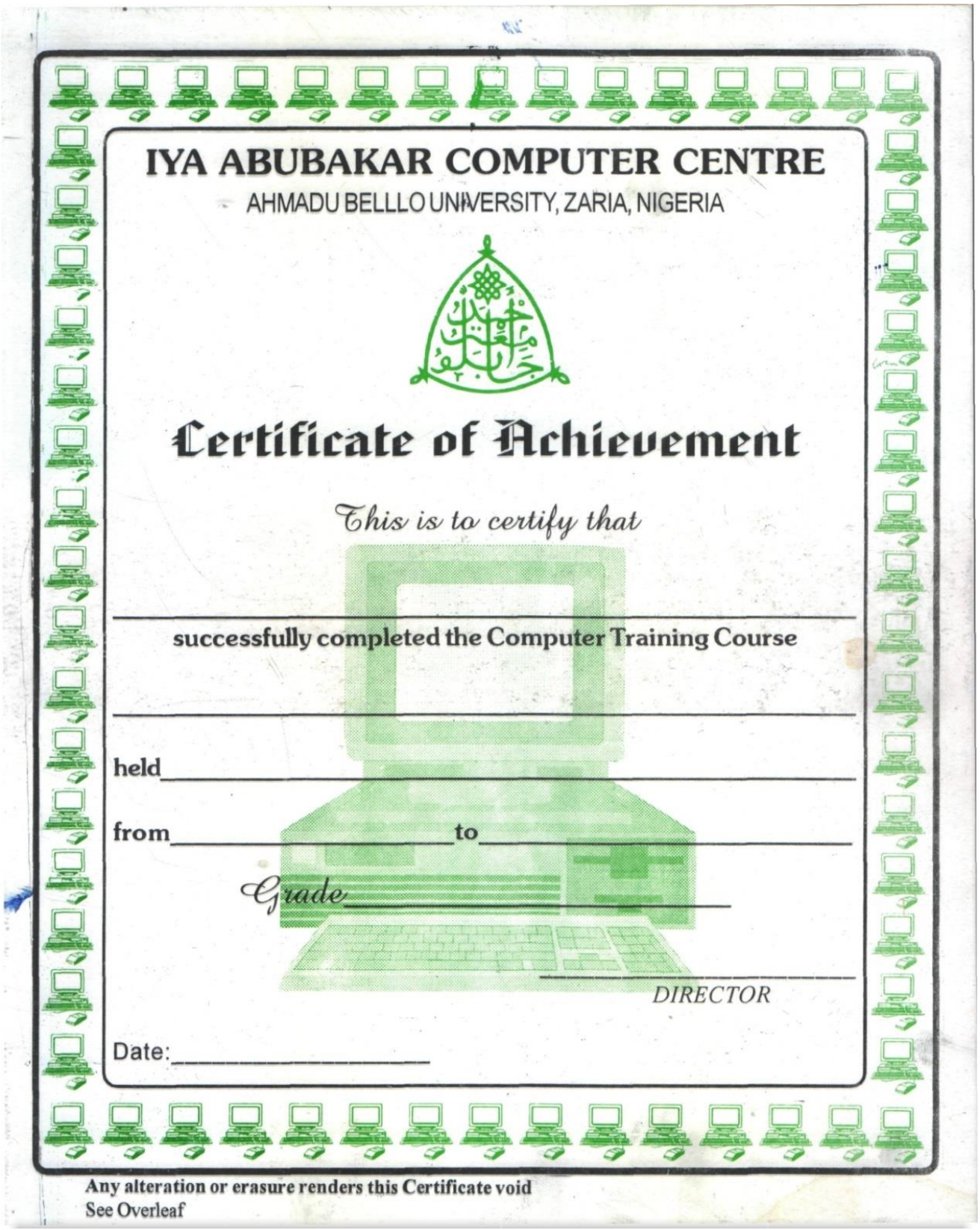
DATE

REGISTRAR

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 5

Counterfeited Ahmadu Bello University, Zaria (Iya Abubakar) Certificate of Achievement



IYA ABUBAKAR COMPUTER CENTRE

AHMADU BELLLO UNIVERSITY, ZARIA, NIGERIA

Certificate of Achievement

This is to certify that

_____

successfully completed the Computer Training Course

_____

held _____

from _____ to _____

Grade _____

_____

DIRECTOR

Date: _____

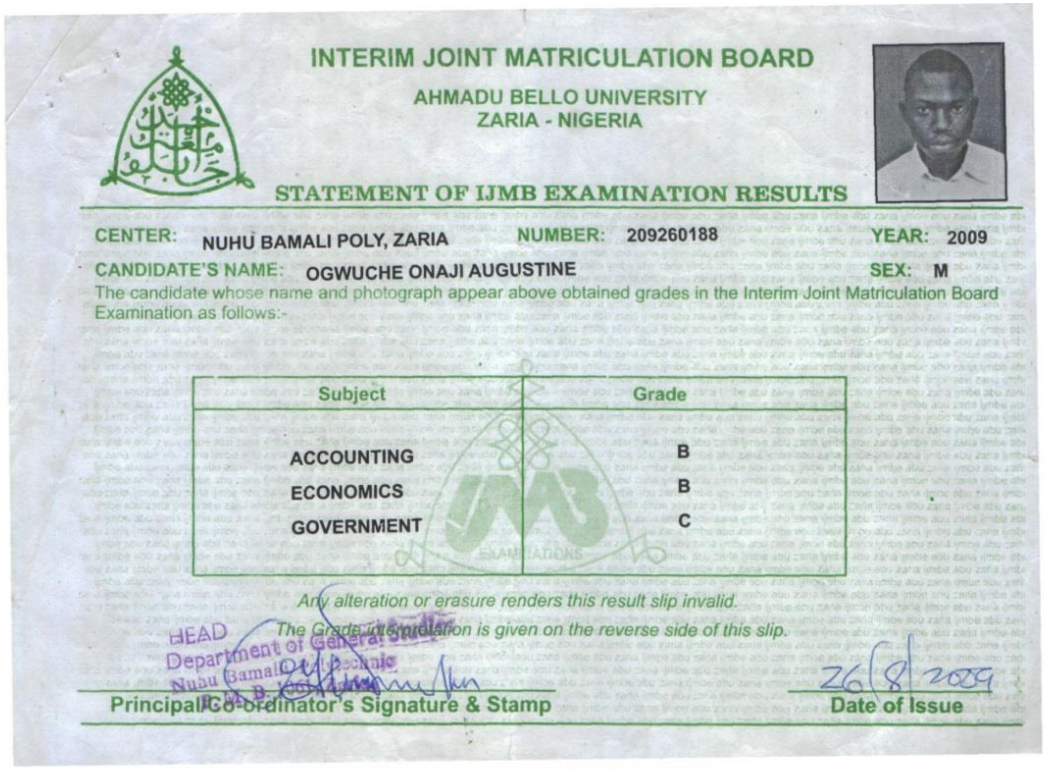
Any alteration or erasure renders this Certificate void

See Overleaf

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 6

Counterfeited Ahmadu Bello University, Zaria (IJMB) Examination Results



INTERIM JOINT MATRICULATION BOARD

AHMADU BELLO UNIVERSITY
ZARIA - NIGERIA

STATEMENT OF IJMB EXAMINATION RESULTS

CENTER: NUHU BAMALI POLY, ZARIA NUMBER: 209260188 YEAR: 2009

CANDIDATE'S NAME: OGWUCHE ONAJI AUGUSTINE SEX: M

The candidate whose name and photograph appear above obtained grades in the Interim Joint Matriculation Board Examination as follows:-

Subject	Grade
ACCOUNTING	B
ECONOMICS	B
GOVERNMENT	C

Any alteration or erasure renders this result slip invalid.

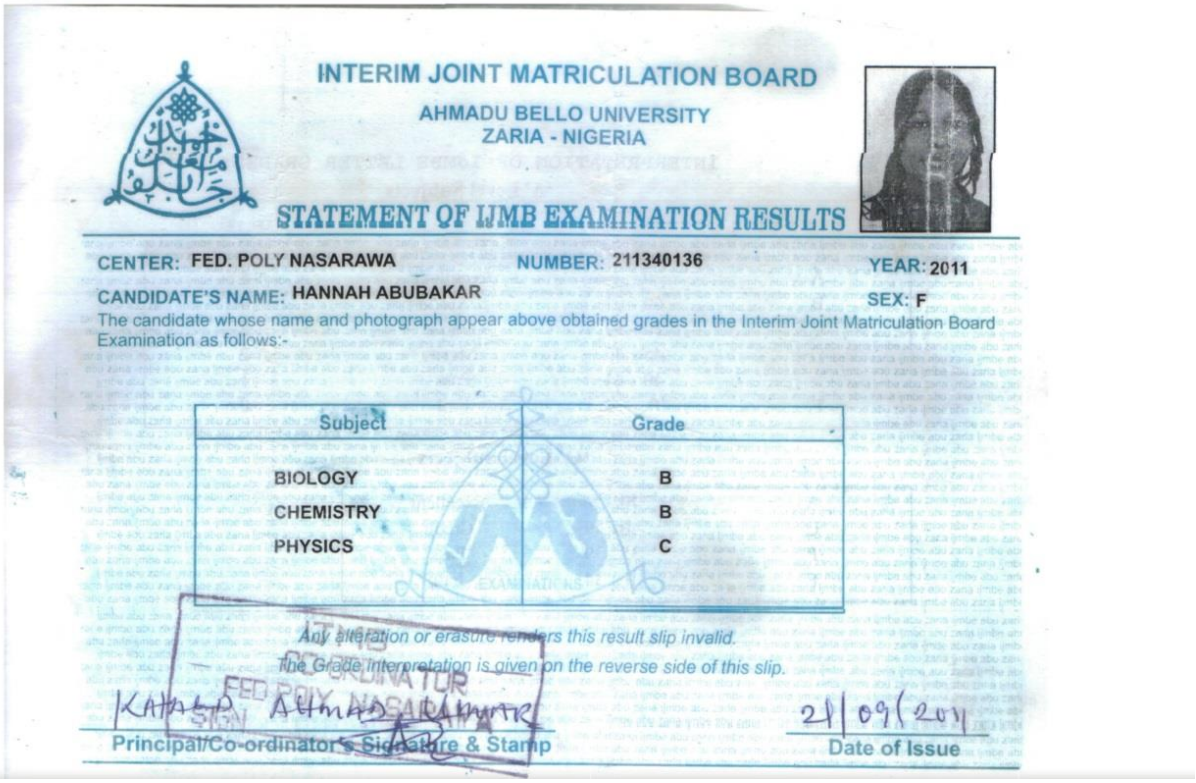
The Grade interpretation is given on the reverse side of this slip.

HEAD Department of General Studies Nuhu Bamali Polytechnic

Principal/Co-ordinator's Signature & Stamp

26/8/2009

Date of Issue



INTERIM JOINT MATRICULATION BOARD

AHMADU BELLO UNIVERSITY
ZARIA - NIGERIA

STATEMENT OF IJMB EXAMINATION RESULTS

CENTER: FED. POLY NASARAWA NUMBER: 211340136 YEAR: 2011

CANDIDATE'S NAME: HANNAH ABUBAKAR SEX: F

The candidate whose name and photograph appear above obtained grades in the Interim Joint Matriculation Board Examination as follows:-

Subject	Grade
BIOLOGY	B
CHEMISTRY	B
PHYSICS	C

Any alteration or erasure renders this result slip invalid.

The Grade interpretation is given on the reverse side of this slip.

FED POLY NASARAWA

Principal/Co-ordinator's Signature & Stamp

21/09/2011

Date of Issue

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 7

Counterfeited Ahmadu Bello University, Zaria (To Whom it May Concern)

AHMADU BELLO UNIVERSITY, ZARIA NIGERIA

Vice Chancellor: Professor Shehu U. Abdullahi,
DVM (ABU). Ph.D (Min.), FCVSN, FIMC, mni

Registrar: Idris Ahmed,
B.Sc Ed. (ABU), MPA, MA (Int. Relations) Syracuse New York, AMIPM>

Telephone: 069 - 551294, 069-550811

Office of the Registrar
(Academic Office)

Ref: R/ACA/GEN/06 **10th October, 1998**

TO WHOIM IT MAY CONCERN

SULEIMAN LAWAL AHMED

I certify that the above named person have sat for IJMB examination in 1998 and passed with the following grades:

Examination No:- 9824082

Economics	-	B
Government	-	D
Sociology	-	C
English	-	C
Basic Maths	-	C

Please treat his case in view of this letter.

Thank you

Yours faithfully

CO-ORDINATOR
IJMB INSTITUTE OF EDUCATION
ZARIA

MALLAM HARUNA MOHAMMED
IJMB CO-ORDINATOR

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 8

Counterfeited Ahmadu Bello University, Zaria Statement of Result

Ahmadu Bello University, Zaria, Nigeria.
Office of The Registrar
(Academic Office)

Affix a Recent Passport Size Photograph

Ref. R/ACA/ADM/03 Serial No. 1580

1999/2000 PROVISIONAL ADMISSION INTO UNDERGRADUATE DEGREE PROGRAMME

M

Name in Full : MOHAMMED LAWA SALISU

Nationality: NIGERIAN State of Origin: KAD LGA: SABON GARI

JAMB No : 99299128IH Entry Score: 180

Faculty/Department: ADMINISTRATION

Course of Study: B.Sc. BUSINESS ADMINISTRATION Level of Entry: 100

I write to inform you that you have been offered provisional admission, as indicated above, subject to confirmation of all registration requirements.

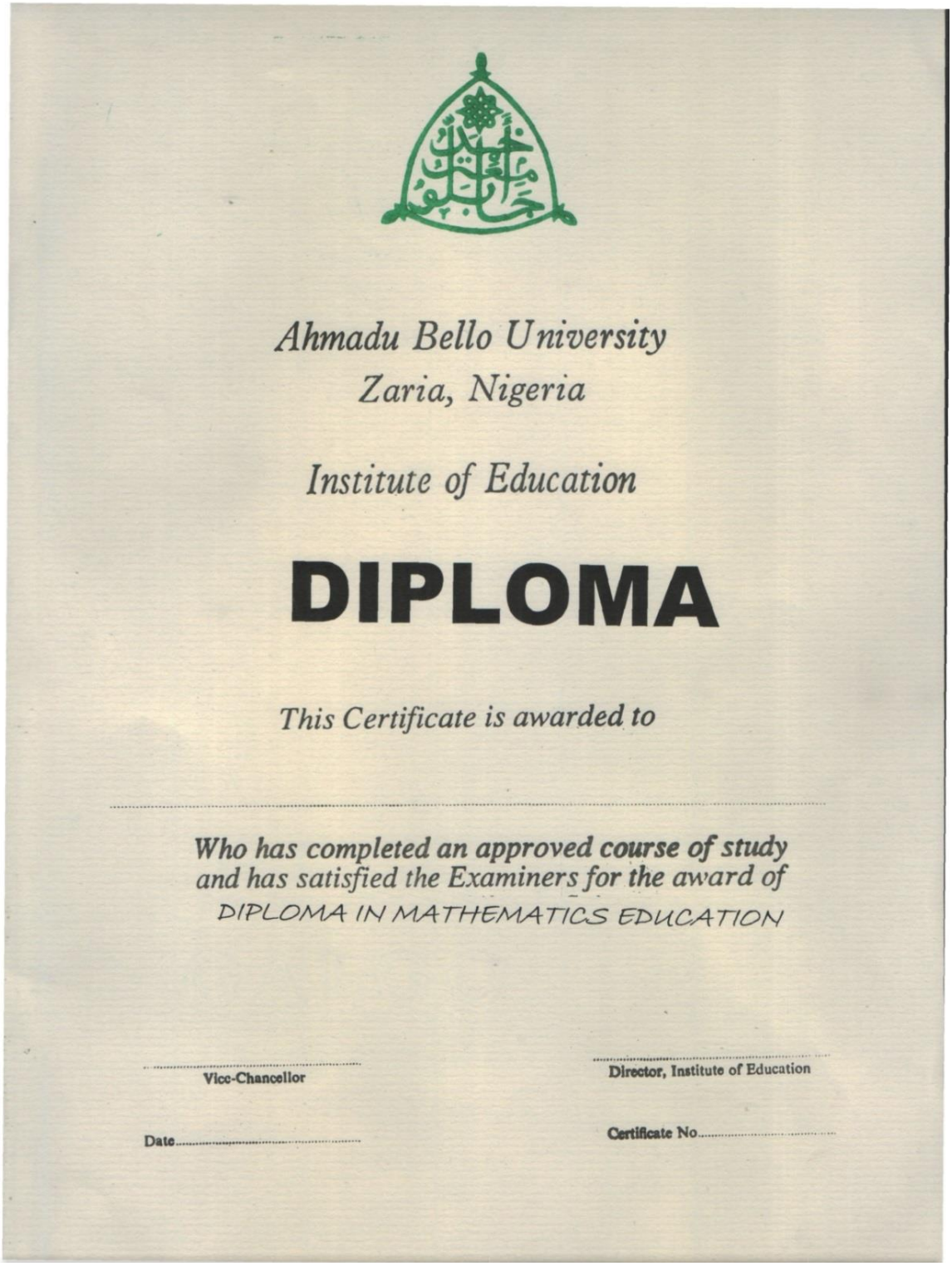
Academic Secretary: B.B. Mshelthlila (Name) Signature: Date/Stamp

Telefax (069)-55002; Telex; 75241 ZARABU, Zaria. 75244 CONG NG; Telephone (069) 550811

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 9

Counterfeited Ahmadu Bello University, Zaria Institute of Education Diploma Certificate



Ahmadu Bello University
Zaria, Nigeria

Institute of Education

DIPLOMA

This Certificate is awarded to

.....

Who has completed an approved course of study and has satisfied the Examiners for the award of
DIPLOMA IN MATHEMATICS EDUCATION

.....
Vice-Chancellor

.....
Director, Institute of Education

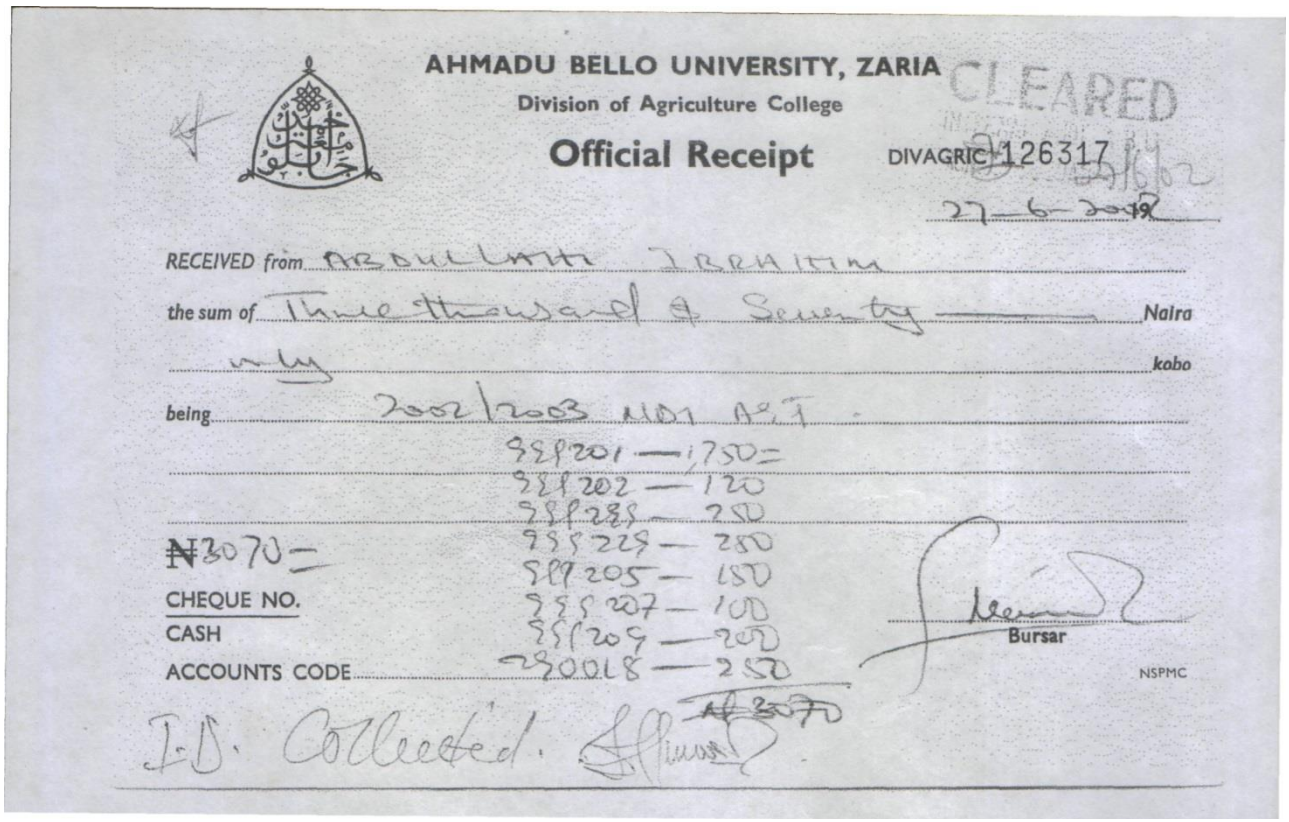
Date.....

Certificate No.....

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 10

Counterfeited Ahmadu Bello University, Zaria Official Receipt



AHMADU BELLO UNIVERSITY, ZARIA
Division of Agriculture College
Official Receipt
DIVAGRIC 126317
CLEARED
27-6-2018

RECEIVED from ABDULLAHI IBRAHIM
the sum of Three thousand & Seventy Naira
only kobo
being 2002/2003 NDI A.T.

SSP201 — 1,750=
SSP202 — 120
SSP288 — 250
SSP229 — 280
SSP205 — 150
SSP207 — 100
SSP209 — 250
230018 — 252

₦3070=
CHEQUE NO.
CASH
ACCOUNTS CODE

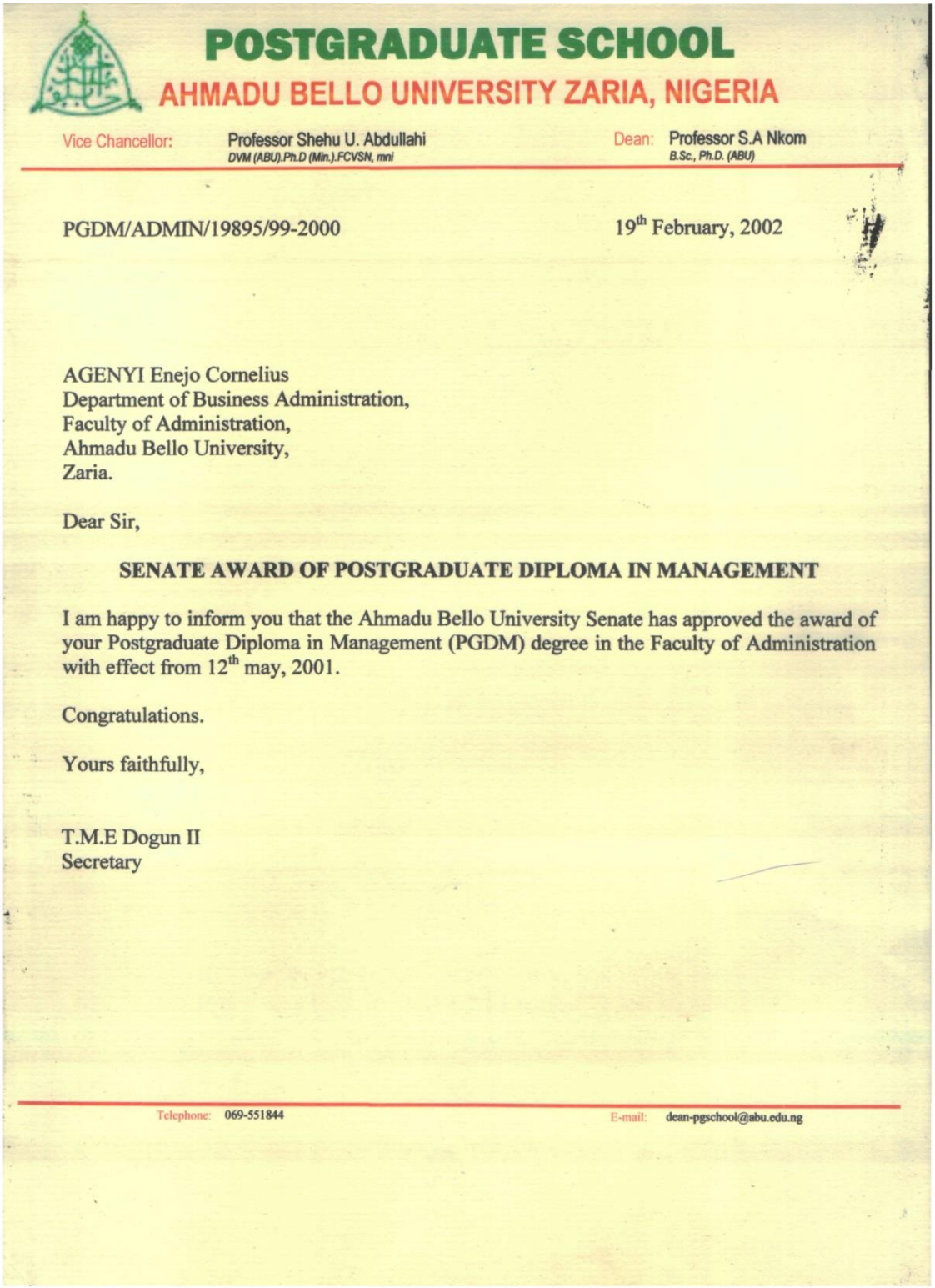
Bursar
NSPMC

I.D. Collected.

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 11

Counterfeited Ahmadu Bello University, Zaria Postgraduate Diploma Statement of Result



POSTGRADUATE SCHOOL

AHMADU BELLO UNIVERSITY ZARIA, NIGERIA

Vice Chancellor: Professor Shehu U. Abdullahi
DVM (ABU).Ph.D (Min.).FCVSN, mni

Dean: Professor S.A Nkom
B.Sc., Ph.D. (ABU)

PGDM/ADMIN/19895/99-2000

19th February, 2002

AGENYI Enejo Cornelius
Department of Business Administration,
Faculty of Administration,
Ahmadu Bello University,
Zaria.

Dear Sir,

SENATE AWARD OF POSTGRADUATE DIPLOMA IN MANAGEMENT

I am happy to inform you that the Ahmadu Bello University Senate has approved the award of your Postgraduate Diploma in Management (PGDM) degree in the Faculty of Administration with effect from 12th may, 2001.

Congratulations.

Yours faithfully,

T.M.E Dogun II
Secretary

Telephone: 069-551844

E-mail: dean-pgschool@abu.edu.ng

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 12

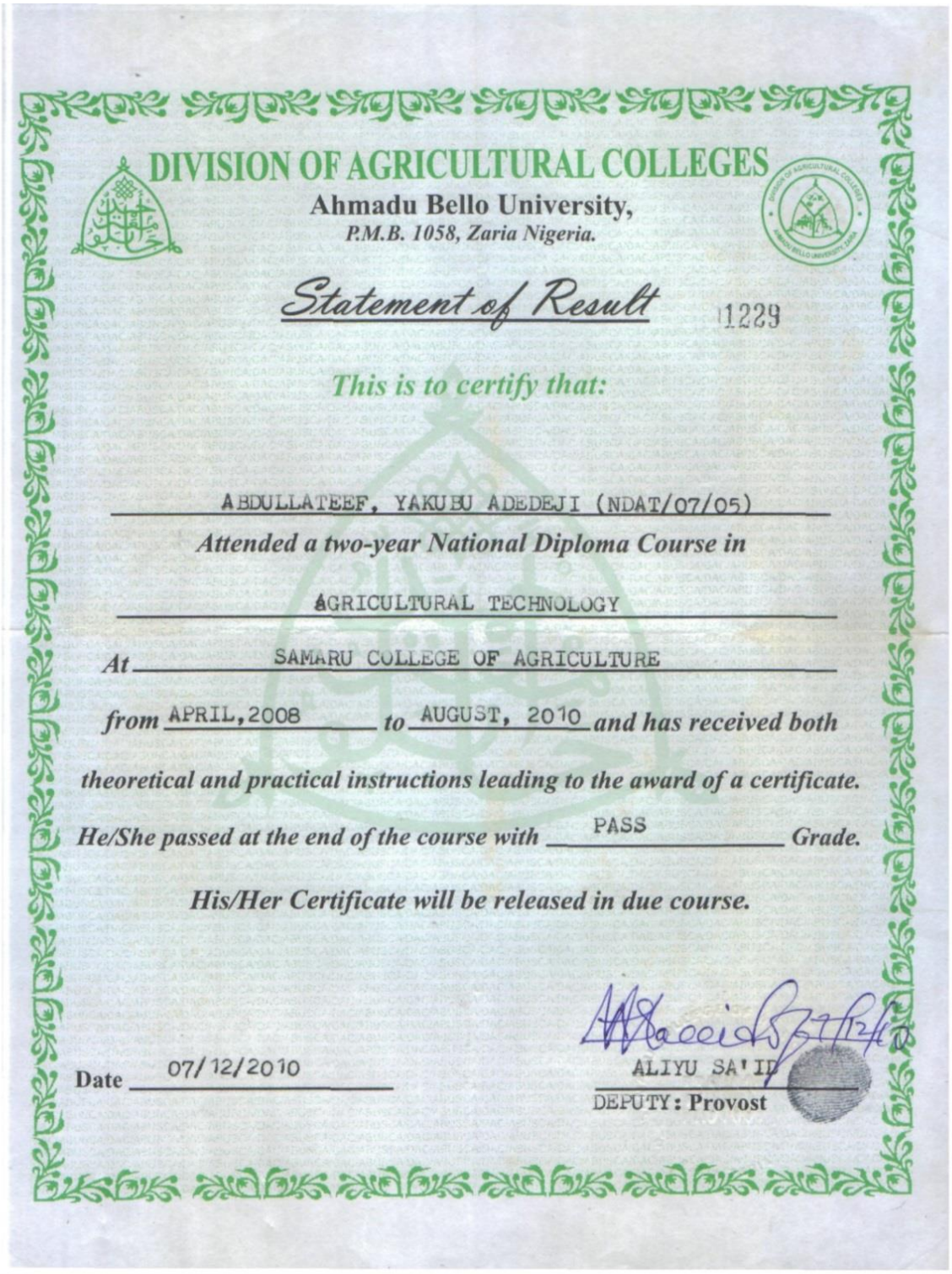
Counterfeited Ahmadu Bello University, Zaria Students' Identity Card



Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 13

Counterfeited Ahmadu Bello University, Zaria (Division of Agricultural Colleges) Statement of Result



DIVISION OF AGRICULTURAL COLLEGES
Ahmadu Bello University,
P.M.B. 1058, Zaria Nigeria.

Statement of Result 1229

This is to certify that:

ABDULLATEEF, YAKUBU ADEDEJI (NDAT/07/05)

Attended a two-year National Diploma Course in

AGRICULTURAL TECHNOLOGY

At SAMARU COLLEGE OF AGRICULTURE

from APRIL, 2008 to AUGUST, 2010 and has received both theoretical and practical instructions leading to the award of a certificate.

He/She passed at the end of the course with PASS Grade.

His/Her Certificate will be released in due course.

Date 07/12/2010

ALIYU SA'ID
DEPUTY: Provost

Source: Ahmadu Bello University Security Unit, Zaria (2016)

APPENDIX 14

Daily Trust Newspaper Saturday August 18 2015

