

TALLINN UNIVERSITY OF TECHNOLOGY

School of Information Technologies
Department of Software Science
E-governance Technologies and Services

ELIZABETH OLUWATOSIN OLANIYI
156408IVGM

**THE ROLE OF NATIONAL ELECTRONIC IDENTITY CARDS
IN ENHANCING PUBLIC SERVICE EFFECTIVENESS: THE
NIGERIAN CASE
MASTER'S THESIS**

Supervisor: **Katrin Merike
Nyman-Metcalf
Professor**

Co-supervisor: **Msury Rogasian
Mahunnah**

TALLINNA TEHNIKAÜLIKOOL
Infotehnoloogia teaduskond

ELIZABETH OLUWATOSIN OLANIYI
156408IVGM

**RIIKLIKUDE ELEKTROONILISTE ID-KAARTIDE ROLL
AVALIKUDE TEENUSTE EFEKTIVISEERIMISEL: NIGEERIA
NÄIDE**

Magistritöö

Juhendaja: **Katrin Merike
Nyman-Metcalf**
Professor

Abijuhendaja: **Msurry Rogasian
Mahunnah**

Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

Author: Elizabeth Oluwatosin Olaniyi

[10.05.2017]

Abstract

The aim of this Master's thesis was to analyse the role of e-ID in enhancing public service effectiveness in developing countries, with special focus on Nigeria. Therefore, the problem statement relied on understanding how electronic Identification (e-ID) can aid public service provision in Nigeria, the current barriers limiting full implementation of the technology in the country, as well as best practices of e-ID management that can be adopted in Nigeria to help rectify the challenges the country may have with e-ID implementation.

In order to comply with these objectives, the case study research methodology was employed while document review and web survey were the instruments for data collection. Owing to this, findings revealed that the National Identity Card (NIC) which is Nigeria's version of e-ID can allow unique identification for citizens and legal residents in Nigeria. The card is also useful for accessing social services and making cash transactions via an online service portal (see [www. services.gov.ng](http://www.services.gov.ng)). More so findings revealed that NIC has not yet been fully integrated into the Nigerian public service domain because of barriers such as low coverage, Government bureaucracy, lack of interoperability, e-ID implementation cost, unavailability of stable internet, enrolment issues, insufficient privacy regulation among other factors. In that event, the researcher proposed a six-stage implementation framework for the Federal government of Nigeria and National Identity Management Commission (the organization charge with statutory responsibility to manage NIC and the National database) to serve as panacea to the barriers discovered and a solution to foster full e-ID implementation in the country.

The thesis concludes that e-ID has a great role to play in enhancing public service effectiveness in Nigeria, just like its contemporaries in the advanced world. This Master's thesis is written in English and is eighty-six pages long, including six chapters, fifteen figures and five tables.

Keywords e-ID, Public services, Nigeria, NIC, NIMC.

Annotatsioon

Magistritöö eesmärk oli analüüsida e-ID rolli arengumaade avalikude teenuste efektiiviseerimisel, eriti Nigeeria näitel. Hüpotees tuleneb arusaamast kuidas elektrooniline ID (e-ID) saab aidata avalikude teenuste pakkumisega Nigeerias, mis tõkked on tehnoloogia kasutamisel ning mida saab õppida teistest riikidest nende ID süsteemide haldamisest, mis saaks aidata riigil ületada e-ID rakendamisega seotud probleeme.

Uuring viidi läbi kaasuste analüüsi, dokumentide uuringu ja veebipõhise küsitluse kaudu. Tulemuseks oli, et Nigeeria rahvuslik ID-kaart on võimeline pakkuda elektroonilist identifitseerimist ja seda saab eri teenuste jaoks kasutada ([www. services.gov.ng](http://www.services.gov.ng)). Probleemidena on vähe kasutamine, liigne bürokraatia, interoperabiilsuse probleemid jne. Autor pakub kuue-tasemelise rakendamise plaani probleemide ületamiseks.

Võtmesõnad: e-ID, avalikud teenused, Nigeeria, NIC, NIMC.

Acknowledgment

I would like to express my sincere gratitude to God, the giver of life and essence for making this entire program a huge success. I also extend my appreciation to my supervisors, Katrin Nyman-Metcalf and Msury Rogasian Mahunnah for their guidance, patience and excellent ideas through out the entire period of this work.

My love and warm wishes also goes out to my siblings and parents Prof and Mrs Olaniyi for their their unending love and support. To my friends over the last two decades of my life who I have shared laughs and cries with, you have been nothing more than bundles of Joy to me.

Thank you!

List of abbreviations and terms

Abbreviation	Description
BVN	Bank Verification Number
EDGI	E-government Development Index
E-ID	Electronic Identification
EU	European Union
HND	Higher National Diploma
ID	Identity Document
IEC	International Electrotechnical Commission
IT	Information Technology
ISO	International Standard Organisation
MDA	Ministries Agencies and Departments
NIC	Ministries Agencies and Departments
NIN	National Identity Card
NIMC	National Identity Management Commission
NRC	National Registration Card
OECD	Organisation of Economic Co-operation and Development
OND	Ordinary National Diploma
OSI	Online Service Index
PPP	Public Private Partnership
PVC	Permanent Voters Card
SSCE	Senior School Leaving Certificate
UN	United Nation

Table of Contents

1	Introduction	12
1.1	Background to the study	12
1.2	Statement of the problem	14
1.3	Research objectives and questions.....	14
1.4	Methodology	15
1.5	Significance of the study.....	15
1.6	Delimitation	16
1.7	Overview of thesis	16
2	Literature review	17
2.1	Introduction.....	17
2.2	Conceptual clarification of national identity document.....	17
2.2.1	Identity document and its characteristics.....	18
2.2.2	Electronic identification and its components.....	21
2.2.3	System component of smart nsational e-ID Card.....	23
2.2.4	Security protection on the smart e-ID csard	25
2.3	Theoretical framework.....	27
2.3.1	The Implementation of e-ID in public services	27
2.3.2	Lessons from early adopters	29
2.3.3	Barriers to e-ID usage in developing countries	36
2.4	Summary.....	40
3	The Nigerian case of e-ID implementation	43
3.1	Introduction.....	43
3.2	A chronology of identity documents in Nigeria	43
3.3	The national identity card (NIC).....	45
3.4	Current state of identity management in Nigeria.....	48
3.5	Summary	51
4	Methodology.....	53
4.1	Introduction.....	53
4.2	Case study research design	53
4.2.1	Advantages of using case study design	55
4.2.2	Limitations of case study design	56
4.3	Method of data collection	57

4.3.1	Document review.....	57
4.3.2	Survey.....	58
4.4	Reliability and validity assessment of data.....	60
4.4.1	Reliability	60
4.4.2	Validity	61
4.5	Summary.....	61
5	Presentation of results.....	62
5.1	Introduction.....	62
5.2	Presentation of findings	62
5.2.1	Section A	62
5.2.2	Section B	65
5.2.3	Section C	67
5.3	Summary of findings	69
6	Recommendations and conclusion	72
6.1	Introduction.....	72
6.2	Recommendations.....	72
6.2.1	Legislative and regulatory support	73
6.2.2	Infusion of structured fiscal policies for NIC implementation.....	74
6.2.3	Development of information technology infrastructure	74
6.2.4	Adoption of organization changes to accomodate NIC.....	75
6.2.5	Promotion of PPP for NIC implementation.....	75
6.2.6	Citizen/customer orientation	75
6.3	Conclusion	75
6.4	Future works	77
7	Bibliography	78
8	Appendix 1 -Web Survey	84

List of figures

Figure 1. Outlook of a smart e-ID card (Balanoi, 2010).	24
Figure 2. Front and back view of the NIMC multipurpose card (Balogun, 2017).	46
Figure 3. Component of the NIMC e-ID (Balogun, 2017).	47
Figure 4. The current state of Identity management in Nigeria (Balogun, 2017).	48
Figure 5. AS-IS and TO-BE Model of ID management in Nigeria (Balogun, 2017)	50
Figure 6. Distribution of departments (Web Survey, 2017).	63
Figure 7. Distribution of respondent's Rank (Web Survey, 2017).	63
Figure 8. Distribution of response according to number of working years (Web Survey, 2017).	64
Figure 9: Distribution of respondents qualification (Web Survey, 2017).	65
Figure 10: Distribution of respondents reaction to question five	66
Figure 11: Distribution of respondent's reaction to question six	66
Figure 12: Distribution of respondents reply to question seven	67
Figure 13: Distribution of response reply to question eight	68
Figure 14: Barriers to e-ID implementation in Nigeria.	68
Figure 15. Framework for full e-ID implementation in Nigeria.	72

List of tables

Table 1. Desirable characteristics of human identification	19
Table 2. Attributes of identification	20
Table 3. Security mechanics of the e-ID system	25
Table 4. Lessons from early adopters	29
Table 5: Difference between qualitative and quantitative research method.....	57

1 Introduction

1.1 Background to the study

Human identification as defined by (Clarke, 1994; Kodl & Lokay, 2001) is the association of data with a person. It is routinely used to help facilitate commercial and government transactions, such as taking out a loan or applying for government benefits (Castro, 2011). According to Lyon (2009), the origin of human identification stems from the modern state in Europe between 1400 and 1600. Although, Berdah (2006) has a slightly different opinion that it was not until after the French revolution that citizenship came to be officially associated with registration and eventually with Identity documents (ID).

Also, relevant to this research was Lyon (2011) argument on the evolution of ID's. He affirmed that the use of such credentials was necessary for security in government administrative duties, where booklets and cards served as identity documents to distinguish citizens for taxation, colonialism, conscription and crime control. Today, governments worldwide are taking bolder and more sophisticated steps in ensuring such type of security with the employment of e-ID. This new technology is believed to be a de facto standard, and it is one of the hottest emerging techniques in the world (Lin, Young, & Zhou, 2015).

E-ID's, unlike traditional ID's, contain biometric information, serves as an official travel document and offers a digital signature function through a public-key infrastructure application (Castro, 2011). E-ID's have also proven to help governments pace and enhance policy outcomes, enable e-services (public and private), improve public service quality and responsiveness to citizens (OECD, 2003), while at the same time facilitating commerce in the digital economy and improving the security of online transactions (Castro,2011). The World Bank in 2015, admitted to the possibility of e-ID to connect national identity to multiple functional applications (cited in Anderson et al., 2016). No wonder many governments have directed their e-ID initiative towards supporting government policies, particularly in areas concentrated towards the delivery of high-quality and cost-effective public services (OECD, 2010; Alshehri & Drew, 2010;

Schuppan, 2009 and Bhatnagar, 2014). Likewise, issues with utmost delicacy where persons would want their sensitive details protected by the law (Digital Single Market, 2016).

Public service here according to (Oyedele, 2015) is designed to be the prime mover of the social and economic development of a nation. In a study conducted by Oladimeji and Said (2012), public service is said to be essential for the maximum performance of government administrative duties in every political community. Along similar lines, Oyedele (2015) argues that governments all over the world depend on a reliable public service to realise the general objectives of their public policies, and they achieve this by translating their plans and programmes into concrete public goods and services for the use of the citizens. The UN General Assembly has publicly expressed her recognition for the potential of e-government in “promoting transparency, accountability, efficiency and citizen engagement in public service delivery” (UN e-government Survey, 2016). We can see this e-government potential in countries like Estonia, Denmark and Finland who through the employment of e-ID and full electronic service delivery have been able to actualise the general purpose of their public services as well as deliver an efficient and effective state administration (Schuppan, 2009). Electronic ID’s in these countries have become a tool for ensuring secure access to online services (Digital Single Market, 2016).

Asides helping government organisations, e-ID is also a relevant tool to private agencies especially in reducing the risk of identity theft and enabling the secure use of online applications in various industries, e.g., to authenticate “online services, securely communicate online, purchase goods and services, and create legally-binding electronic signatures, such as to sign a contract”(Castro, 2011). Thus, traditional forms of identification such as passports and birth certificates have become obsolete and less used for conducting transactions on the internet. With the growing need of e-ID in Europe and the rest of the world coupled with its prospects for both public and private sector organisations, it has become imperative to investigate what influence e-ID card will have in strengthening public service effectiveness in developing countries with focus on Nigeria.

1.2 Statement of the problem

Governments of developing countries, Nigeria inclusive, face many difficulties in their administrative duties. One of which involves the inability of their public services to efficiently improve the general welfare of its citizens (Oyedele, 2015). Adebayo (2000) throws more light into the Nigerian case by expressing that the public service has degenerated and that it will take years to wake it up. Reasons being that the government of the country has been unable to effectively manage public services and ensure prompt delivery to everyone in a non-discriminatory manner (Oyedele, 2015).

In Nigeria, despite the ongoing implementation of e-ID by the National Identity Management Commission (NIMC) and migration of few public services online, citizens are still subjected to the rigour of visiting government offices, long waiting hours on queue and bureaucratic processes before they can access most of these services (Martin, 2014). Consequently, Nigeria and other developing countries who find themselves in similar situations have not taken optimum advantage of their e-ID especially in the aspect of accessibility and availability of public services to both citizens and businesses as recorded in highly innovative nations in the world. For this reason, this research sets out to achieve the following objectives.

1.3 Research objectives and questions

The general focus of this paper is to find out and recommend how e-ID can improve public service effectiveness. Especially in areas concerning user experience and interaction of governments (agencies and employees), businesses and citizens in Nigeria. Hence, the following research questions if answered, we believe would help to achieve the set objective.

Q1. How can e-ID aid public service provision in Nigeria?

Q2. What are the current barriers to e-ID card usage in Nigerian public service?

Q3. How best practices of e-ID management can be adopted in the Nigerian public service?

1.4 Methodology

In order to sufficiently answer the questions mentioned above, the case study research design was considered as the appropriate methodology to be used. This choice was made because the researcher wanted to have an intensive investigation of the Nigerian case of e-ID implementation, especially since theoretical evidence is already indicating the inability of the government to ensure high quality service delivery and the e-ID technology has proven itself credible in this area.

In addition to the profound examination of the Nigerian case, the researcher intends to give a comparison with some selected countries around the world. As such, the literature review will discuss best practices of e-ID implementation in five early adopters and delimitations in a few developing countries as well. The reason for this is to observe the different approaches and decisions these countries had to make to adopt e-ID in administering their public services. More so, to identify some problems peculiar to developing countries when enforcing e-ID technology, so we can look out for them in our study about Nigeria.

Furthermore, the researcher has chosen to employ both primary and secondary method of data collection for the study. Thus, secondary data would include document review as noted earlier while primary data will be gathered using web questionnaire with a combination of both open and close ended questions. In terms of reliability of data collected, stability of inference made from data collected will be used to determine consistency of the data while construct validity would be used to measure the instruments.

1.5 Significance of the study

The contribution of this study will add to the existing body of knowledge in both practice and public service theory. The study is expected to benefit the National Identity Management Commission, Ministries, Agencies, as well as the Federal government of Nigeria, in integrating e-ID into the country's public service domain. Similarly, the study will also highlight the current barriers to e-ID usage in the country, and suggest the need to adopt best practices of e-ID management in Nigeria for better and sustainable public service delivery. Most importantly, the study is also expected to contribute a framework that

could be used to align the philosophy of government service and e-ID management in Nigeria and developing countries at large.

1.6 Delimitation

This study is focused on appraising the usefulness of e-ID implementation on public services in developing countries most especially in the aspect of user experience as the world is gradually becoming a digital society and citizens now expect that active services are readily available and accessible at their disposal. However, due to time constraints, the researcher has chosen a limited research coverage and has focused concentration on the Nigerian case while taking best practices from early adopters of e-ID technology in a few EU countries like Austria, Denmark, Estonia, Germany and Sweden.

Although there is credible evidence to show that the Nigerian government runs multiple e-ID schemes (Balogun, 2017) for example the Permanent voter's card (PVC), the Bank verification (BVN) card, the National Driver's Licence and the National Identity Card (NIC). Nonetheless, our study will only place emphasis on the NIC because it is the official document that has been mandated by the Federal government of the country to serve as an identity document for all Nigerian citizens and legal residents.

1.7 Overview of thesis

This thesis comprises of six chapters. In this first chapter, an introduction to the related field is given, followed by the problem statement, the research objective and question, methodology, significance as well as delimitation and an overview of the entire thesis. Chapter two focuses on the conceptual clarification and theoretical framework for the study including a literature review. The third chapter introduces the case study which is the Nigerian National electronic identity card. The fourth chapter initiates the methodology of the survey. The fifth chapter presents findings from empirical research, while in chapter six, recommendation and conclusion for this study will be discussed.

2 Literature review

2.1 Introduction

This chapter reviews document and theories relevant to our study. As such, it is broken down into three sections. The first part which is the conceptual clarification focuses on defining basic terms such as identity, National identity documents and electronic identification. Sections two which is the theoretical framework explores various works of authors and their findings in line with the theoretical concepts and practice as it relates to the current research. The theoretical concept section is divided into two sub-sections; the first sub-section explains identity document and its characteristics while the second sub-section discusses the concept of e-ID and its components as it relates to the current research topic.

Furthermore, the theoretical framework section sheds light on the planning and successful implementation of e-ID in five selected countries. The countries include Austria, Denmark, Germany, Estonia and Sweden in comparison with the present barriers to e-ID implementation in developing nations, for example Nigeria which is the primary focus of this research. The aim here is to provide the necessary framework for this study and recommend the best practices that could be adopted not only in Nigeria but other nations struggling to implement e-ID. Subsequently, the chapter ends with a summary of the entire discussion.

2.2 Conceptual clarification of national identity document

Many authors tend to disagree with the use of National Identity documents such as e-IDs, based on reasonable arguments. Some of which centre on privacy issues, implementation challenges and cost, (Arora and Ganley, 2008; Anderson et al. 2016), without paying much attention to the brighter side of how the use of such technology can enhance public service effectiveness particularly in developing countries. The following subsection will discuss what an identity document is as it relates to the study.

2.2.1 Identity document and its characteristics

To fully understand what a national identity document is, we will start off by explaining what the concept identity itself means. Identity is the individual's “unique sense of self, distinguishing self from others” (Ashforth, Harrison, & Corley, 2008; Kornum, Gyrd-jones, Al, & Anthony, 2017). Apart from this definition, Cap and Maibaum (2000) see it as,

a parameter associated with a person (e.g., name, age, place of work), to ensure that real world operations are invoked on the correct individual (e.g., putting a person in jail, awarding a prize to a person), to verify, whether a person has certain rights (e.g., to drive a car, to pick up tickets for a theatre performance) or to engage in communication acts with the intended addressee (e.g., sending a letter or an email). (p.804)

In a different opinion, social identity theorists like Postmes et Jetten (2006b: 260), have also defined identity as “that part of an individual’s self-concept which derives from his knowledge of his membership of a social group (or groups) together with the value and emotional significance attached to that membership” (cited in Tanis & Beukeboom, 2011, p.786).” We believe that it is this need to associate as an active member of a social group or share a common bond that gives credence to the modern state placing so much attention to “individual details as part of the embrace of the individual” (Torpey, 2000 cited in Lyon, 2009). Lyon throws more light on the subject matter by explaining that Torpey used the word embrace to denote “grasping or registering citizens by the state in ways that both include and exclude persons” (e.g., differentiating citizens from the resident or foreign nationals), and one reason for this according to him was to ensure citizens trust as well as guarantee their entitlements. These entitlements are sourced for by mobilising economic resources through taxation and then later redistributed to citizens in need through welfare programs, in areas major such as health and education. Therefore, it is right to suggest that bringing public services using identification systems is a significant aspect of governance which can be traced as far back as the creation of the modern state systems.

According to Clark (1994, p.8),

identification is applicable to data stored in a structured, tangible and manageable form, as in corporate databases and documentary filing schemes; but also to data stored in less formal ways, as in private notes; and in incorporeal form, as in ballads and human memory.

The discussion here implies that the concept surrounding the term identification does not merely focus on the process of identifying or registering alone, but relates to the use of documents such as identity cards. In many countries, the duty of providing identity cards for enabling citizens to verify their identity to authorities and private organisations like banks are considered as a responsibility of the government (Sorge, 2016). According to Nguyen (2003) the ownership of an ID allows eligible bearers benefit from public services provided by the government. Thus, Vassil (2015) emphasises that such documents should be compulsory for all citizens for identification.

When nations consider the choice of national identity documents, there are desired characteristics of ideal identification management defined by Clark (1994) that must be met (see table 1 below).

Table 1. Desirable characteristics of Human Identification

Universality of Coverage	Every relevant person should have an identifier.
Uniqueness	Each competent person should have only one identifier no two individuals should have the same identifier.
Permanence	The identifier should not change, nor be changeable
Indispensability	The identifier should have one or more natural characteristics which and individual has and retains. If artificial, the identifier must be available all times.
Collectability	The identifier should be collectable by anyone on any occasion.
Storability	The identifier should be storable in manual and in automated systems.

Exclusivity	No other form of identification should be necessary or used.
Precision	Every identifier should be sufficiently different from others so that mistakes are unlikely.
Simplicity	Recording and transmission should be easy and not error prone.
Cost	Measuring and storing should not be unduly costly.
Convenience	Measuring and storing the identifier should not be overly inconvenient or time-consuming.
Acceptability	Its use should conform to contemporary social standards.

(Adapted from Clark, 1994, p.21).

The description by Clark above gives us the understanding that there are distinct features a standard identification document should have, one of which is uniqueness, especially the sort that does not permit one person to have two of the same kind of identifiers (for example, two personal identification codes). The foregoing discussion also implies that the identifiers should be all-embracing such that different services can use it. This system is not carried out in many countries, not just developing ones and it is visible in the many cases of countries that run multiple identity documents by their various government bodies and ministries. One obvious example of this is in Nigeria as noted earlier where a couple of identity schemes operate for their different public services.

To further buttress his argument on the characteristics of an identification document Clark (1994), explains that the identifier or means of identification on the document described above should have individual human identification attributes all of which he illustrated in table (2) below.

Table 2. Attributes of Identification

Means of Identification	Clark's Definition	Example
Appearance	How the person looks	Use of photographs on identity documents, facial biometrics

Social Behaviour	How the person interacts with others	Education records, mobile phone records, credit card statements, video surveillance data
Name /Codes	What the person is called by Other people or by an organisation	Name listed in the national registry, on passports, birth certificates, ID card numbers, social security numbers.
Knowledge	What the person knows	Passwords, PINs
Tokens	What the person has	Smart cards, Secure ID cards
Bio-dynamics	What the person does or is	Most forms of biometrics: fingerprints, iris, retina.
Imposed Physical Characteristics	Who the person is now	Height, weight

(Clark 1994, p.10. Also, cited in Arora & Ganley, 2008; Cap & Maibaum, 2000).

These attributes according to Clark, (1994) are based on some distinct features associated with the individual and unique to them alone, such that they are capable of sufficiently verifying the identity of the people.

For a very long time, nations have incorporated these attributes into their different ID models mostly paper based. However, many countries are currently replacing their paper cards with more sophisticated ones that contain electronic and biometric components (Anderson et al., 2016). One good example is the case of China whose first-generation ID card was introduced in 1985 and then advanced to the use of a technology-enabled card with a microchip using Radio Frequency Identification (RFID) technology in 2004. We find evidence of similar cases in a whole lot of European countries (Castro, 2011; Rissanen, 2010; Ducastel, 2015) as well as developing nations like Vietnam, Bangladesh, Ecuador, Ghana, Iran, Kenya, and Sri Lanka and even Nigeria which is the central focus for the study (Anderson et al., 2016).

2.2.2 Electronic identification and its components

E-ID is a technology that allows the use of a person's identification data in an electronic form. The technology according to the European Union Regulation No 910/2014 can be

material and an immaterial unit containing an entity's identification data, which is valid for both physical identification and authentication of online services. In clearer terms, it is described as both portable (the plastic card) and virtual (the database) (Lyon 2005; Balanoiu, 2010). The term entity referred to above according to the European Union Regulation No 910/2014, can be “a natural person or a legal person, or a natural person representing a legal person”. Arcelia & Adriano (2015) throws more light on this by explaining that the word natural person here is an individual who can assume obligations and holding rights. While the second group of individuals also known as juridical personality most often describes a collection of people working together as a private entity or public-sector body.

Today e-IDs have become necessary citizenship documents and can be used to monitor the entire population in a country. As a result, Kapralou, Hert, & Roosendaal (2011), citing Clark purported that e-ID's are used for “mass surveillance” and many nations have incorporated it into their National Identity Schemes.

Duncastle (2015) defines a National Identity scheme as “the set of laws, standards, supervision and facilities that can contain one or more e-ID means (and their systems) and are acknowledged as a national facility by the corresponding country”. Ducastel (2015) report also reveals that Electronic identification can be carried out through different means. Some which includes:

username-password, Username-password with text message verification, Software-based (public key infrastructure (PKI)) certificates, Smartcards with contact (a card reader is necessary) or contactless chips (the card is equipped with a transmitter that makes the chip readable at a distance) on which a certificate is placed or Mobile ID.

In addition, an e-ID connotes a system that offers valid access to an electronic service. This means it can be public or private and can function within or outside an e-ID scheme, but the current research is on general e-ID means recognised in most national e-ID systems. Normally, the general practice is that most countries choose one or more of the following e-ID means for their national identity: smartcards, mobile phones, one-time passwords, and software-based certificates on a PC. Nevertheless, the researcher will be focusing on smart cards used by most government, e.g., Austria, Denmark, Estonia,

Germany Sweden and even Nigeria (which is the central thrust of this research) as National Identity document (Balanoiu, 2010).

2.2.3 System component of smart national e-ID card

Smart cards are designed to incorporate within their thickness one or more integrated circuits (see figure 1 below). Hendry (2007), mentions that these cards can also be called “chip cards or integrated circuit cards”. Studies have also shown that the most appropriate smart cards used for identification processes are those that include public key cryptographic functionalities. Along similar lines Balanoiu (2010), opines that such smart cards:

generate a private-public key pair; store the private key in an inaccessible store (the key cannot be retrieved from the smart card, it can only be used internally in performing cryptographic functions); retrieving the public key for publication; sign data using the private key; decrypt data encrypted with the public key; generate certificate requests containing the public key; store certificate responses from certification authorities. Besides asymmetric cryptographic functionalities they can usually perform symmetric encryption and decryption, biometric enrolment.

The appropriate format for technology-enabled smart card is defined in the ISO/IEC 7810:2003 international standard. This specification, mentions four formats of identification cards: ID-1, ID-2, ID-3 and ID-000. The standard also laid emphasises that ID-1 (banking cards) should have a dimension of 85.60 mm x 53.98 mm (Hendry, 2007; Balanoiu, 2010). The standard further provides that the physical conditions of the card should also be in line with their specifications such as “bending stiffness, flammability, toxicity, resistance to chemicals, dimensional stability, adhesion or blocking, warpage, resistance to heat, surface distortions, and contamination” (ISO/IEC-7810).

Figure 1 titled: Outlook of a Smart e-ID card below gives us a pictorial view of a standard Smart e-ID card.

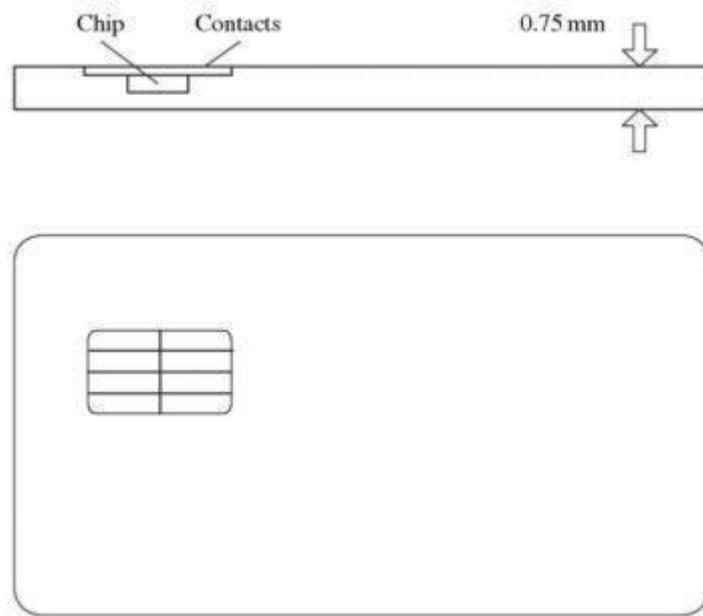


Figure 1. Outlook of a Smart e-ID card (Balanoiu, 2010).

These smart cards are either contact or contactless depending on a country's choice as discussed above. Although (Castro, 2011) notes that contact cards are mostly prevalent in many European countries, e.g., Belgium, Estonia, Italy, Portugal and Spain. Nigeria also makes use of smart contact chips in her National e-ID card, while Netherlands and Germany have been identified to provide the contactless cards. The major difference between these two cards is that while a contactless card uses radio frequency identification (RFID) to read the digital information stored on it, the later would require physical contacts and therefore employ the use of a card read (Poller, et. al, 2012).

Aside the standard on physical outlook, other best practices on e-ID set by international standards organization according to Balanoiu (2010) includes:

- ISO 7813 that defines additional characteristics of ID-1 identification cards;
- ISO 7811 that defines techniques for data recording on ID-1 identification cards;
- ISO 7816 that defines ID-1 identification cards with an embedded chip (smart card) and contact surfaces;
- ISO 14443 defines identification cards with an embedded chip and a magnetic loop antenna; and

ISO/IEC 7501-3:2005 that allow machine-readable e-ID's to serve as e-passport document for administrative efficiency in border crossing (Castro, 2011). The

International Civil Aviation Organization (ICAO) in their Document 9303, has also endorsed the use of machine-readable e-IDs as official travel documents.

2.2.4 Security protection on the smart e-ID card

The Smart National e-ID card is an essential prerequisite and key enabler for the secure identification, authentication and digital signing on the Internet. Moreover, these three important basic forms of protection have been spotted to be used by most governments in the world primarily as a part of all aspects of enforcing a secure e- service design (Cited in Melin, Axelsson, & Söderström, 2013). Fiat and Shamir were the first to give a definition of these key protections using the acronym I-A-S which connotes Identification, Authentication and Signature, details of which has been illustrated in the table (3) below.

Table 3. Security mechanics of the e-ID system

Identification (I)	A can prove to B that he is A, but someone else cannot prove to B that he is A.
Authentication (A)	A can prove to B that he is A, But B cannot prove to someone else that he is A.
Signature (S)	A can prove to B that he is A, but B cannot prove to himself that he is A.

(Source: Arora & Ganley 2008).

From the description above we can see that Smart e-IDs have embedded in them advance security mechanisms like the ones earlier discussed by Balanoi (2010) that prevent falsification of identity and fraudulent use of identity documents. In addition to this, Castro (2011) acknowledges that Identification, authentication and signing technologies are some of the fundamental building blocks needed for e-services and each of these is carefully explained below.

2.2.4.1 Identification

One advantage smart e-IDs have over traditional paper national IDs according to Hendry (2007) is that it does not usually need to recognise the person. According to him, the common approach here is to “verify the person's identity, to determine whether the individual is whom he or she claims to be, which is much easier and faster than recognition, which involves a significant amount of computing time and database

searches”. Performing electronic identification is a key feature of the e-ID technology as noted in earlier discussions. As such the main function of a smart e-ID card like every current identification document is to carry out identification. Carrying of electronic identification with this smart document is paramount so that authorities in charge of access control applications or passport applications would be able to tell if the person behind the computer using the smart document is the actual owner cited in Balanoiu (2010). He further emphasised that in the two scenarios mentioned above “it is mandatory that the system ensures the pairing between the person and the smart card”. To guarantee this, the most commonly used human characteristic used for biometric matching is the fingerprint (Clancy, Kiyavash, & Lin, 2003).

There are usually three approaches to adding biometric information to smart card systems, and they include Template-On-Card (TOC), Match-On-Card (MOC) and System-On-Card (SOC) (Balanoiu, 2010). In the Nigerian case, the approach used is TOC. Some Countries in the European Union (EU) like Estonia for instance, have encouraged the use of electronic identification especially for public service applications such as internet voting, accessing government databases to check one's medical records, file taxes, picking up electronic prescriptions just to mention a few (European Commission, 2013).

2.2.4.2 Authentication

Authentication is also another security protection provided using e-ID technology as explained above. It is “the corroboration of a claimed set of attributes or facts with a specified or understood level of confidence” (European Commission, 2005). This service is usually of two types; entity authentication and data origin authentication. Entity authentication centres on confirming the identity attributes of the persons involved, while data origin authentication focuses on verifying the integrity of the data source (ISO/7498-2:1989).

According to a news report (on the republic of Estonia) gotten The Economist (2014), “secure, authenticated identity is the birth right of every Estonian: before a new-born even arrives home, the hospital will have issued a digital birth certificate, and his health insurance will have been started automatically”.

2.2.4.3 Digital signature

An electronic signature according to (ISO 7498-2) is “data appended to, or a cryptographic transformation of, a data unit that allows a recipient of the data unit to prove the source and integrity of the data unit and protect against forgery e.g. by the bearer.” The European Union Directive 1999/93/EC (Art.2.1) also defines it as “data in electronic form which are attached to or logically associated with other electronic data and which serves as a means of authentication”. It is also equivalent to the above authentication. Castro (2011) describes this better by explaining that,

digital signatures use a technique known as asymmetric cryptography requiring two components: a private key for the sender to use to sign a document and a public key for the receiver to use to verify the signature and that these keys are generated by a certificate authority, e.g., a trusted third party such as a private company or the government.

Electronic signatures are believed to bear the same legal capacity as handwritten signatures. Consequently, many nations have endorsed it to be legally binding for both e-government and private sector uses.

2.3 Theoretical framework

This section gives a review of relevant literature to the current research. Thematic issues discussed includes the implementation of e-ID in public service, lessons from Early Adopters (Austria, Denmark, Estonia, Germany and Sweden) of e-ID technology and common barriers to the card usage in developing countries.

2.3.1 The implementation of e-ID in public services

Rapid advancement in e-ID technology in recent times has brought about much improvement in the way people live, work, interact as well as care for each other. This new system as explained earlier is integrated into public administration especially in areas of human development such as primary health care, commerce, education and social services. Today e-ID cards are designed by various (national) government ministries (Arora, 2008; Naumann et Hogben, 2008). In addition, UN development Index Survey

for 2016 showed that 98 countries in the world already require e-ID for online or mobile services and their goal is to achieve citizen-centred services that are relevant to each.

The use of e-ID in public service centres on some theories one of which is the New Public Service Movement. This movement “encourages public services to be more egalitarian and recognise equal rights of citizens” (Denhardt & Denhardt, 2007). Correspondingly, novel approaches such as (Dunleavy, Margetts, Bastow, et Tinkler, 2006) “digital governance” and “the paradigm of population data” integration through e-ID cards (Rahardjo, 2016) were developed in response to this new movement in order to promote equal rights of citizens as well as obtain national identity. Khatchatourov et Laurent (2014) have emphasised that “e-ID in the public sector is believed to be a driver for stronger e-government adoption by citizens, while the private sector (banks, travel companies) may also be interested in secure solution linked to identity.”

Today, governments offer e-services to citizens and business via e-ID cards (Castro, 2011). Hence citizens can complete and sign forms electronically from anywhere in the world via the internet. Business can equally interact safely with the government online mostly for activities such as paying taxes or requesting permits which helps in reducing the need to take time-consuming trips to government offices or public notaries. Some examples of government services that e-ID cards are used for includes: my people services in Denmark, tax-on-web in Belgium, verification of e-voting in Estonia and secure e-mail which is created alongside digital identity in Estonia and Finland (Millard & Carpenter, 2014; Castro, 2011; Vassil, Solvak, Vinkel, Trechsel, and Alvarez, 2016; Kalvet, 2012; Arora and Ganley 2008; Rissanen, 2010) just to mention a few. Besides from the above, Arora and Ganley (2008) also disclosed that Non-government organisations in EU, especially in the Nordic countries use e-ID in two forms. Its first use is as a secure signature creation device (SSCD) while the second use is to sign documents electronically with legal validity and collaboration with financial institutions.

In addition, studies have shown that much of the investment on e-ID's has been in Europe. As such we see most of the vast development on the national e-ID among her member states with the creation of the interoperable European Citizen Card (ECC) standard (Castro, 2011). Moreover, its single market strategy also shows a very solid record for delivering consistent and trusted public services in the world and it aims to “design and

deliver public services to better serve citizens and businesses, while reducing costs, opening digital opportunities, and enhancing Europe’s position as one of the world leaders in the digital economy” (UN survey, 2016). All these would not have been possible without the use or implementation of e-ID.

The first known case of a national e-ID scheme was in Finland in 1999 (Rissanen, 2010). By 2014, the EU Regulation No 910/2014 on electronic identification and trust services for electronic transactions in the internal market (eIDAS Regulation) was introduced. This regulation permits secure electronic identification (e-ID) as a critical enabler of service delivery, data protection and the prevention of online fraud. As a result, there was an increased need for the use of e-ID among member states in the EU for interactions between businesses, citizens and public authorities. In addition, Ducastel (2015) in his studies affirmed that most of these countries consider similar policy-related aspects such as ‘availability’, ‘accessibility’, ‘privacy’, ‘security’ and ‘ease of use’, when integrating public services into their e-ID even “though they come to different conclusions based on similar values to these aspects.”

2.3.2 Lessons from early adopters

Ducastel (2015), made it very clear that many countries have different motives for building or choosing to use e-ID technology based on their various national difference and challenges. Castro (2011) also draws us to the attention that many nations have initiated these national e-ID schemes with the aim of using it as an enabler to public services. Table 4 below highlights the various approaches in use by five selected early adopters of e-ID technology in the EU. We selected these five countries based on the UN 2016 Online Service Index (OSI). These five countries which are Austria, Denmark, Estonia, Germany and Sweden fell under the category of very high OSI (more than 0.75). The index also mentions that countries under this category projected innovative approaches to transform public sector and the delivery of services (UN survey, 2016).

Table 4. Lessons from Early Adopters

Country	Policy Consideration	Financing
Austria	The Austrian card name “Personalausweis” was initiated in 2000. The card is voluntary. However,	User cost for the Austrian card is €61.50. The Austrian

	<p>it is required in public administration as defined by their General Administrative Procedure Act. Their approach is a multi-means strategy of public and private cards as possible carriers of an e-ID means. This system allows all citizen cards store basic personal information, including the assigned unique identifier, known as the source PIN. As such ATMs, student ID, health insurance and government cards were incorporated into this model. In 2009, mobile-ID solutions were also included (for improved convenience and usability).</p> <p>Amongst other things, availability of service and ease of use were some of the important policy consideration for their national e-ID model.</p> <p>Policies related to their e-ID were made open and technologically neutral as possible.</p> <p>Since identity protection was also an important part of this scheme, the government ensured that identifier was not on the certificate and the certificate comes from a private certificate authority (under the supervision of the government).</p> <p>The banks were not left out. The government also incorporated Austrian banks in this model, and they can generate an electronic signature as defined by Austrian law.</p> <p>Above all the Austrian e-ID system emphasises interoperability with different e-IDs, a unique feature common with Austrian e-ID system.</p> <p>The Austrian government has also promoted the e-ID, by making freely available the software needed for its use by citizens and standards by developers.</p>	<p>government purchases certificate through a tender; different ministries contribute. However, the introduction of Mobile ID left questions about who would bear the financial cost of text messages.</p>
<p>Denmark</p>	<p>When it comes to the aspect of e-government, Denmark is advanced and has high ambitions. Several of its public services are mandatorily digital, this allowed high penetration of its e-ID means. However, the Danish government does not work with a national card based e- ID system. Therefore, introducing an e-ID card was not among the options available to her government. Furthermore, since the government was aware that it lacked the relevant knowledge to implement an e-ID solution itself she called for</p>	<p>In respect to funding, the government foots the bill for about one-third of the total costs. In exact figures, the Danish government spends a standard amount of 200 million DKR (€269,006) for a five-year period. This money is supplied in the state budget by the different levels of</p>

	<p>tenders from the private sector to introduce NemID, a new e-ID solution.</p> <p>This new ID is a common log-in solution for Danish Internet banks, government websites and some other special companies. Moreover, it is managed by the Nets DanID A/S. The solution is valid for five years and has been in operation for almost a decade now. The present tender will end in 2017, and a new one is developed. According to the Danish model, the high-level e-ID market for e-Government services is insufficiently mature and cannot do without government stimulation, due to its e-Government ambitions.</p>	<p>government, following a fixed calculating rule.</p> <p>Other non-government actors in the e-ID market bear the remaining financial costs.</p>
<p>Estonia</p>	<p>Estonia was one of the very first countries to adopt the use of e-ID, taking precedence from Finland. Europe's Digital Progress Report (2016), recognised Estonia to have the highest score for digital public service in the EU and her approach towards e-ID card usage in the country was pragmatic.</p> <p>She launched her first e-ID in 2002 with an active policy called 'Digital Estonia'.</p> <p>The country's success story is based on certain key factors which include:</p> <ul style="list-style-type: none"> ● Legal and Regulatory support which centres on critical areas like compulsory use of e-ID cards, privacy, data protection, digital signature. ● Public-private partnership (The Estonian e-ID project includes strong cooperation between public and private-sector partners. The cards are administered by a government agency while private partners, (two banks and a telephone company) manage the electronic infrastructure. ● Adequate funding, e.g., like the provision for ICT expenditure in their state budget ● Leadership and public-sector competence ● Technology and Infrastructure (She has one of the most highly advanced and sophisticated national e-ID card systems in the world (Cappemini, 2007). Moreover, they provide a higher possibility for financial transactions than the banking means that were previously used). ● Active campaign and awareness on the use of 	<p>Citizens pay a fixed production cost at enrolment centres during the time of issuance of the Estonian e-ID. The fee is a one-time payment of €25 if the application is made in Estonia and €50 when made in foreign embassy.</p>

	<p>e-ID technology</p> <ul style="list-style-type: none"> • Tech-savvy citizens (Before the introduction of the card bank e-ID means were being used for e-Government, so Estonians were accustomed to this sort of system). 	
Germany	<p>Germany introduced her e-ID in 2010. The German approach makes use of public identification means to monitor privacy and safety. Although there has been a lot of scepticism about this as citizens fear that the use of the e-ID may intensify privacy invasion due to its Nazi and Stasi past where the government was storing data about its citizens.</p> <p>Some private actors participated in the production of the German e-ID although with a minimal amount of governmental control.</p> <p>The German card is a contactless smart document. Germans also use mobile IDs whereby the cell phone functions as a card reader for the e-ID card.</p>	<p>Like the Estonian case. Germans pay for their e-ID card. The German government also makes provision for the financial costs of other expenses in their Federal budget. Furthermore, if citizens forget their PIN, a re-activation fee will be paid.</p>
Sweden	<p>Sweden's approach just like the Estonia case is pragmatic, and it involves both public and private means as possible e-ID carriers. Since Government organisations, as well as private entities in Sweden, normally use personal data and numbers their e-ID model took account of privacy and had made laws for it as applicable in other EU countries.</p> <p>The Swedish government created an open market for private (and public) suppliers of e-ID means. Only qualified stakeholders could join this system. The approved authentication was mostly that of the bank, and it dominates the system. The banks in Sweden are very much trusted, even during a recent crisis. Subsequently, Public e-ID mean was also incorporated into this system.</p>	<p>In the Swedish case, the government buys 'validation control' (pay per validation) of private actors.</p>

(Adopted from Ducastel, 2015; Aichholzer & Strauß, 2010; Castro, 2011; OECD, 2010; Martin, 2010; Harrow and Krim, 2001).

After reviewing the different approaches used by the selected countries in table (4) above, we can acknowledge that each country has a specific approach on e-ID implementation based on some features peculiar to them such as historical past, governance style and administrative ethics. It is important to point out some of the valuable lessons from the various systems which would be further explained below.

2.3.2.1 The need for legislative regulation and support

Evidence from the Austrian case study also shows that introducing e-ID into public administration and service delivery challenges both the legislative process and workflows within distinct authorities and agencies (Arora and Ganley, 2008). Therefore, adapting some legal and organisational changes are required to ensure efficiency in these two areas. Building a strong legal and regulatory support is essential for successful implementation of e-ID to public administration and service delivery in every country. In fact, it is a prerequisite for widespread usage as indicated in most of the models above where the law mandates the use of e-ID. To support this argument, the UN 2016 index also specified that “Increased integration of e-ID technology requires building appropriate legal frameworks and security systems to guarantee the privacy and confidentiality of personal data” (UN Survey, 2016).

We also see this in some of the regulations and directives set by the EU to member countries and have been adopted by all the states mentioned above. These laws include: Regulation (EU) No 910/2014 (electronic identification and trust services for electronic transactions in the internal market that support e-signature, the once only principle and the digital by default agenda), Directive 95/46/EC (EU Data Protection Directive) and Directive 2014/55/EU for e-invoicing and procurement (Ron, 2015) just to mention a few. Moreover, many countries are working hard to standardise some of these laws, for instance, United Nations Survey (2016), shows that:

a privacy statement is now available on the national portal of 101 countries; In 141 countries, the government offers a security feature such as https and a digital certificate for online services, and in 113 countries personal data protection legislation is available online.

Nigeria is not excluded from this list of countries, as Chapter IV, section 37 of its 1999 Constitution shows that “the privacy of citizens, their homes, correspondence, telephone conversations, and telegraphic communications is hereby guaranteed and protected”.

Gellman (2013), makes us understand that the sensitivity of privacy issues has been one of the driving forces that has encouraged the government to adopt data protection laws on access to personal information across government agencies. In some other countries, their government have put in place certain security measures concerning information access and citizen privacy. For example, “strict clearance levels are required to access the UID

database in India,, (UIDAI, 2012). In Pakistan, the system is a little different, their National Database and Registration Authority (NADRA) introduced software capable of allowing citizens to see what organisations or individuals have accessed their data (Malik, 2014). This is also like the Timestamp used in Estonia. According to Buldas and Laud (1998), Timestamps allow individuals to ascertain the date a digital document was “created, signed or last modified”.

Another cogent fact Castro (2011) opens our eyes to is that the absence or presence of a mandatory national identification card is an important policy factor influencing the diffusion of e-IDs. We can see this in some of the models displayed above, e.g., the Estonia case. In the same vein, we could see that although the Austrian and Danish approach did not make acquisition of e-IDs compulsory by law, the government still had to mandate certain legislation that allowed the use of e-ID. For instance, laws on digital services. Castro (2011), added that the practices of introducing compulsory e-IDs have become rampant and is available in some countries around the world. In essence, it would be advisable for governments and private corporations in developing countries and the world over, many of which are still in the early stages of their e-ID implementation to consider enacting the above-mentioned policies in balancing both security and efficiency in their government. These is because such frameworks are needed to: allow e-ID card usage in public service administrative workflow, to encourage digital transactions in government services, and above all to guard against identity theft and fraudulent use of use of identity documents.

Furthermore, policymakers should take heed to (Castro, 2011) advice of making such laws technology neutral as used in most of the countries mentioned above so that such laws would encourage innovation, would be susceptible to new administrative process and would remain viable whatever technology is used.

2.3.2.2 The presence of adequate infrastructure

According to Castro (2011), while many nations have passed legislation to support the use of e-ID, few have invested in the large-scale implementation of the digital infrastructure needed to make the technology available and accessible to citizens. In the Estonian model, for instance, the government provides open source e-ID software for all and sundry to ensure the use of e-ID on all platforms. Also, the government have invested

in information systems and databases such as X-Road; a data exchange layer that allows officials as well as legal entities and private individuals to process data from national databases over the Internet within the limits of their authority” (cited in Kalvet, 2012). This generous act on the part of Estonian government as well as similar governments who are into such practices has been one of the success factors supporting the successful implementation of e-ID technology for their better and efficient public service delivery in their different countries.

2.3.2.3 Adequate funding

The issue of financing is another important aspect to consider when embarking on National e-ID projects especially since in most cases, the overall aim of introducing the technology is to improve government administrative efficiency by reducing cost and enhancing public service quality. From the models above we can see that is it not often advisable for the government alone to bear the financial burdens of running national e-ID project else, they might run out of funds especially in cases of low-income earning countries. Therefore, developing countries can learn from the Estonian and German models that allow a citizen to take part in bearing some of the cost, e.g., paying a fixed cost for their e-IDs during issuance (Castro, 2011).

2.3.2.4 Encouraging public-private partnership (PPP)

According to Castro (2011), the public sector is typically involved in e-ID governance, such as developing and implementing the legal, organisational and technical framework and standards. However, there is the need to encourage cooperation among these bodies when it comes to the implementation of e-ID technology. In the Estonian and Danish models for instance (see Table 4 above) we can see a real public-private rapport. The sort that enters contracts with private companies to run key elements of the e-ID implementation project under government supervision. Aside these two cases discussed above, another example is the Malaysian case, where private-sector participation was involved from the initial design phase of the e-ID implementation. The sector’s involvement in this design helped in supporting non-e-government applications from the beginning (Arora and Ganley, 2008).

We also see this strong partnership in service delivery as well in some other countries of the world. To prove this, the UN Survey (2016), shows some statistics for online services

in partnerships with civil society and the private sector. The statistics revealed that 36 EU countries had adopted innovative partnerships, 32 countries had done so in Asia and 28 in the America. Currently, there are eight countries with innovative partnerships in Oceania and 23 in Africa.

A UN (2015) report, also emphasised that:

Multi-stakeholder partnerships can harness the resources, knowledge and ingenuity of the private sector, civil society, the scientific community, academia, philanthropy and foundations, parliaments, local authorities, volunteers, and other stakeholders.

Especially when such collective power is necessary to mobilise ideas, expand knowledge, experience, provide technological and financial resources as well as supporting attainment of Sustainable Development Goals (SGD), in developing countries (UN General Assembly, 2015a). We can say that public-private partnership is an excellent strategy and it is necessary for successful e-ID implementation in every country and should be encouraged.

2.3.3 Barriers to e-ID usage in developing countries

Having talked about a couple of e-ID models in European nations who have both the financial and technological capability to run successful national e-ID schemes, it is likewise essential to note some of the challenges significant to later adopters, especially those in developing countries which is central to our study.

Defining the term developing countries may seem to be a daunting task considering that there is no universal definition of the term. The United Nations, however, defines it as:

“a country with a relatively low standard of living, undeveloped industrial base, and Human Development Index (HDI)”. This index is a comparative measure of poverty, literacy, education, life expectancy, and other factors for countries worldwide. The index was developed in 1990 by Pakistani economist Mahbub ul Haq and has been used since 1993 by the United Nations Development Programme in its annual Human Development Report” (Cited in Educational Pathways, 2017).

The widespread lack of e-ID in developing countries is a critical stumbling block to national growth (Mariana Dahan, 2015). This is founded on the argument that developing, implementing and managing public e-services and secure e-ID solutions are challenging

(Rissanen, 2010; Bühler et al., 2014; Liginlal et al., 2012) and require coordination and management (cited in Melin, Axelsson, & Söderström, 2013). A study conducted by the International Telecommunication Union (ITU), which reviewed 48 national identity programs and initiatives in 43 developing countries came to a conclusion that full e-ID implementation in developing countries is hindered by obstacles such as lack of institutional accountability and transparency, privacy, data management issues, enrolment challenges, cost, lack of architecture technical challenge and inadequate public service participation (Anderson et al., 2016), all of which are discussed below.

2.3.3.1 Lack of institutional accountability and transparency

Anderson et al. (2016), study indicated that perceived presence of corruption surrounding contracts and tenders in Guatemala, Malawi, Mozambique, Nepal, Thailand, and Uganda resulted in visible accountability challenges on the macro level leading to delays in the implementation of their e-ID programs. Another instance is the case of Thailand where implementation of the identity program has been slowed down twice (in 2006 and again in 2010), due to the suspicion of corruption in the auction process (Gao & Gunawong, 2010).

Similarly, there were also traces of such manipulation in Uzbekistan where limited information on regulations and security led citizens to believe that there was some political manipulation in place (Landinfo, 2013).

2.3.3.2 Privacy

There has been much opposition to the use of the e-IDs system in the world today. One instance is the case of Civil Liberty groups in the United States of America and the United Kingdom who claim that the use of e-IDs may call for large-scale privacy invasion of citizens by their government (Unger, 2010 and Loo, 2007). In China also, there are concerns over how easy it is for police to monitor citizen's movements and personal information using their identity document especially when it can be used to target certain groups (Chen, 2003; Keane, 2006).

2.3.3.3 Data management issues

Data registries as noted by Clark (1994), is an important part of identification systems and therefore are indispensable in maintaining a functional national e-ID scheme. In the

following countries, Bangladesh, Burkina Faso (voter card), Ghana, Guatemala, Indonesia, and Mali there have been reports of challenges with data maintenance (Anderson et al., 2016). In the Ghanaian case, the problem was that the central database infrastructure for the ID project was completed, but data capturing did not take place until five years later which led to inconsistency between the number of citizens registered for the program and those with recorded data. As such Fifteen million Ghanaian citizens registered with the national civil registry, but only nine million were input into the central database (Akrofi-Larbi, 2015).

About Bangladesh, Burkina Faso (Voter Card), and Guatemala, the problem was that citizen's information gathered for the scheme were of mixed quality and coverage which created complications as countries moved to establish their national identification programs (Gelb and Clark, 2013; Eulich 2011). For this reason, Guatemala, for example, had to re-print over 2.9 million cards with data corrections (Eulich, 2011).

2.3.3.4 Enrolment challenges

Enrolment for e-ID registration is another factor that has been observed by Anderson et al. (2016), as a factor limiting effective registration campaigns in several e-ID programs. According to him, this challenge is caused by inadequate resources such as:

“broken or insufficient equipment and materials as in the case of Cambodia, Indonesia, Nigeria, Peru, Thailand, Ukraine” (Biometric Passport).

They also noted that under-trained staff mostly disadvantaged in speaking local dialect especially in a multi-ethnic state with diverse culture, can limit human resources and therefore stand a challenge to the enrolment procedure as applicable in Indonesia, Peru, Sri Lanka, Uganda. Other factors about enrolment challenges according to them are a lack of logistical support, guidelines, or public awareness regarding the enrolment process and this is evident in countries like Algeria, Indonesia, Nigeria Bank Verification Number (BVN) card Nigeria (e-ID) card and Zambia (NRC).

2.3.3.5 Cost

According to Anderson et al. (2016), financial and capital challenges incurred from national e-ID schemes are often associated with delays or indefinite suspensions in enrolment and production as seen in Cambodia, Cote d'Ivoire, Malawi, Tanzania, and Uganda.

From their work, we could see evidence leading to the fact that National Registration and Identification program in Malawi experienced a one-year delay because of inadequate funding until it was allocated additional funding from the national budget (Chilunga, 2015), while the program in Cote d'Ivoire was suspended on several occasions because of insufficient funds to deploy and pay the technical enrolment teams (The Carter Centre, 2011).

2.3.3.6 Technical challenges

According to Belamri (2015), technical challenges such as a bad system architecture design, lack of standard interoperability model and low ICT coverage can be a limiting factor to e-ID implementation in developing countries. One example is the adoption of the digital biometric ID card in Algeria that has been delayed due to difficulties in providing logistical and equipment services (Anderson et al., 2016).

To further discuss the problem of interoperability, Adebisin (2013) believed “fragmentation and lack of standardisation” were some of the major interoperability issues countries face. The issue of interoperability has become more important as countries deploy e-government systems. In order to provide high-quality services to citizens, it is important that services can be accessed from the widest possible range of equipment. Similarly, Resolution 76 (Johannesburg, 2008) on conformance and interoperability testing considered:

That some countries, especially the developing countries, have not yet acquired the capacity to test equipment and provide assurance to consumers in their countries; and that increased confidence in the conformance of information and communication technologies (ICT) equipment with ITU-T Recommendations would increase the chances of end-to-end interoperability of equipment from different manufacturers, and would assist developing countries in the choice of solutions (cited in ITU, 2008).

On the other hand, Arora and Ganley (2008), believed significant barriers such as the lack of basic ICT infrastructure could also deter many developing countries from integrating e-IDs to their public services. This problem is very popular in Latin American countries which have been reported to have such problems (Montenegro, 2011). To solve this

internet problem, developing countries may consider employing the Georgian innovative customer centric approach of bringing public services closer to their citizens by providing public service halls as well as village development centres (Open Government Partnership, 2015). In the Georgian case, public service halls and centres were nicely built and equipped with reliable electric power supply, internet service, as well as necessary staff and information that would improve citizen's public service experience in a comfortable environment. The buildings were also placed in strategic locations especially in remote areas where there are higher rates of digital divide (Malecki, 2003).

2.3.3.7 Inadequate public-sector participation

As seen in the various cases discussed in Table 4 above the need for the great public-private partnership about e-ID implementation in every country cannot be overemphasised. Arora et Ganley (2008), believed e-ID projects are mostly introduced by various national governments, ministries and agencies with limited participation from the private sector. Therefore, creating a lack of third-party (i.e. non-Government) applications for e-ID cards as discussed earlier.

In a similar, argument the authors mentioned that this limited private sector involvement might be explained by a lack of public service policies to involve private entities in the e-ID implementation design and deployment. However, the future of this will be transformed, as various countries have started issuing out their technology-enabled cards and the private companies find innovative means to use the cards for secondary use scenarios (Siddharth Arora & Ganley, 2008).

2.4 Summary

This chapter is of two parts, conceptual clarification and theoretical framework. The introductory section gave a definition of basic terms such as such as identity, National identity documents, and electronic identification, to help the reader understand concepts as it relates to the study. This section also provided table 1 titled: Desirable characteristics of Human Identification as adopted from the studies of (Clark, 1994) and Table 2 titled: Attributes of Identification (Clark 1994, cited in Arora and Ganley, 2008; Cap & Maibaum, 2000) respectively. This section further progressed to explaining why nations have shifted from the use of paper-based identification documents to technology-enabled

ones as noted by Anderson et al. (2016). The discussions then advanced to explaining the system components of an e-ID system as defined by ISO/IEC specifications. At the later part of this section, table 3 was provided and titled: The Security Mechanics of the e-ID system as illustrated by Fiat and Shamir. The arguments of these two authors is that e-ID's can perform the following three security functions, identification, authentication and signature. Which according to Balanoi (2010) can sufficiently help to prevent falsification of identity, fraudulent use of identity documents and aid public service access

In section two, the researcher reviewed studies of other authors on issues relating to the implementation of e-ID in public services. Here the likes of Khatchatourov et Laurent (2014) emphasised that:

e-ID in the public sector is believed to be a driver for stronger e-government adoption by citizens, while the private sector (banks, travel companies) may also be interested in secure solution linked to identity.

To confirm this argument, Castro (2011) asserts that government today offer e-services to citizens and business alike via e-ID cards with the aim of using it as an enabler to public services. Some examples of which includes: My People Services in Denmark, Tax-On-Web in Belgium (Millard and Carpenter, 2014; Castro, 2011), Verification of e-voting in Estonia (Vassil, Solvak, Vinkel, Trechsel, & Alvarez, 2016; Kalvet, 2012) and Secure e-mail which is created alongside digital identity in Estonia and Finland (Arora and Ganley 2008; Rissanen, 2010) just to mention a few.

The second part of this section shows Table 4 titled: Lessons from Early Adopters highlights e-ID model and approaches from some selected member states in the EU as adopted from the work of Ducastel, (2015); Aichholzer and Strauß, (2010); Castro, (2011); OECD, (2010); Harrow and Krim (2001). Since authors like Castro (2011); Arora and Ganley, (2008) and Rissanen, (2010) have grandly appraised EU member states as an early adopter of e-ID technology. The selected countries were picked based on the UN 2016 Online service index (OSI). These countries include: Austria, Denmark, Estonia Germany and Sweden fell under the category of very high OSI (more than 0.75). The index also mentions that these countries stood out because of the innovative approaches they used to change the public sector and delivery of services (UN survey, 2016). After reviewing this model, it was important to note out some of the valuable lessons learnt

from the selected countries various approaches. Some of the lessons learnt included: The need for Legislative and Regulatory Support, the presence of Adequate Infrastructure, Adequate Funding and Encouraging Public-Private Partnership.

Having talked about the various e-ID models in European nations who have both the financial and technological capabilities to run successful national e-ID schemes, the last part of this section centred on finding out significant challenges cogent to later adopters of the technology enabled card, e.g., developing countries such as Nigeria which is the central focus of this study. Barriers such as lack of institutional accountability and transparency, privacy, data management issues, enrolment challenges, cost, lack of architecture and widespread ICT as well as inadequate public service participation (Anderson et al., 2016) were examined as some of the biggest challenges developing countries experience when implementing e-ID into their various national systems. On that account, chapter three would introduce us to the Nigerian case which is our major focus for this research.

3 The Nigerian case of e-ID implementation

3.1 Introduction

In the previous Chapter, our discussions took the reader through the definition of technical terms as it relates to our study. We also drew their attention to some lessons from early adopters of e-ID technology in the EU like Austria, Denmark, Estonian, Germany and Sweden who have been recognised by the UN to have performed exceptionally well in this area, while also noting some major challenges developing countries undergo in the process of implementing this new technology into their public administrative duties.

In this chapter, we will introduce Nigeria as the case study for this research and the chapter will be divided into three parts. The first part will give a historical antecedent of National identity schemes in the country up until the present scheme which was established in 2007. The second part will present details of the National identity cards, and finally, the last section will present information about the current state of identity management in the country. These discussions are pertinent to the proper understanding of the case study by the reader, and it is also crucial to the general objective of the thesis.

3.2 A chronology of identity documents in Nigeria

It is common knowledge that the Federal Republic of Nigeria is the most populous black nation in Africa, with a population of 191.835,936 million (World meters, 2017). According to World Bank Data (2016), Nigeria situates in sub-Saharan Africa, and she is a developing country with a lower middle income.

An overview of identity schemes in Nigeria reveals that the first known case was envisaged in 1967 under the regime of General Yakubu Gowon who was the Head of State as at that time. The scheme was supposed to be driven towards “identifying the Igbos who refused to heed the call to return to the East during the civil war” (Weekly Trust, 13 October 2000). However, the idea soon died off as no serious implementation decision was made. In 1978, the Directorate of National Civil Registration (DNCR) was established and was granted the authority to issue simple laminated identity cards to Nigeria’s above the age 18 under decree 51 of 1979 (Vanguard May 13, 2003). General Olusegun who was Gowan's predecessor formally inaugurated the scheme on September

1st, 1979. The scheme lasted 18 months, and issuance of card stopped as soon as General Obasanjo left office with only a few people benefiting from it.

Subsequent military regimes were unable to continue this long dream of initiating a unified government identification scheme for Nigeria until Olusegun Obasanjo came back as president under a civil democratic government in 1999. His administration then proceeded to re-introduce national identity cards 2003 (IRIN 4 Mar. 2003; Nigeria First 18 Feb. 2003; Nigeria Business Info.com 18 Feb. 2003; The Daily Sun 3 May 2004; BBC 18 Feb. 2003). Those who participated in this exercise were required to provide personal data like name, age, sex, address, occupation, their state of origin, local government area, height measurement, thumbprint, and passport photograph (Privacy and Human right report, 2006). The registration for this identity card was not compulsory. However, it became one of the requirements for accessing public services including health insurance (IRIN 4 Mar. 2003). A total of 60 million Nigerians were eligible to register for this card out of the then 120 million inhabitants in the country (Privacy and Human rights report, 2006). Records, however, showed only 52 million Nigerians participated in this scheme between the period of February to March when the program was put to a halt (This Day, 3 June 2004).

In 2006, the modus operandi changed slightly as fingerprint embedded identity cards were introduced into the Nigerian System. By June 2007, distribution had taken place in 27 states of the Federation (The Guardian, June 8, 2007). Soon enough allegations were raised that many aliens had registered for these cards, therefore, defeating one of the major objectives of the system (Africa News, March 6, 2005). In response to this new development, the then “Minister of Internal Affairs requested that the Nigeria Immigration Service strictly monitor identity card distribution” (Africa News, March 6, 2005). This, however, did not last long.

In the wake of 2007, the National Identity Management Commission (NIMC) pronounced as “Nimcee” was set up by a National Policy and NIMC (Act No. 23, of 2007). This commission was created to replace the former DCNR, which had now been dissolved. NIMC took over all DCNR assets and liabilities, including the staff from both state and local government offices all over the country. According to Sections 1, 2, 5 and 6 of No 23 of the (NIMC Act, 2007), The Commission was established:

To foster the orderly development of an Identity Sector and build a modern Identity Management System for Nigeria: Create, operate and manage a secure, sustainable National Identity Database; Build and manage Identity Authentication and Verification Service Infrastructure; Establish Permanent Registration Centres across the country to enrol every Nigerian and legal resident at his/her convenience - service delivery at its best; Issue a chip based, highly secure and user friendly Multi-application Smart Card to facilitate e-governance, online / offline identity authentication and verification, and secure electronic payment” (cited in NIMC Annual Report Account,2014).

According to Olaleye and Agbota (2009), the Nigerian government when introducing the National Identity Card (NIC) wanted it to meet the objective the previous scheme failed to achieve such as:

being a tool to control illegal immigrants in the country, validating other civic documents such as the travelling passports, setting up a reliable personal identification system for securing commercial transactions with financial institutions.

Intrinsically, Hartmann and Onyemenam (2015), confirms that this new scheme would be addressing all those issues as the NIC is capable of combating identity fraud, enabling citizens to make e-payments during service transactions. They were also of the opinion that the card has the potential to foster the growth of digital culture amongst Nigerians especially in the aspect of improving public service user experience and e-governance at large.

3.3 The national identity card (NIC)

The Nigerian National Identity Card (NIC) like all e-IDs previously discussed is a smart document. “The Federal government of Nigeria was able to put this remarkable card together through a collaborative effort between NIMC (the project leader), MasterCard (payments technology provider), Unified Payment Services Limited (payments processor), Crypto-vision (Public Key Infrastructure and Trust Services Provider), and Access Bank Plc (pilot issuing bank) (Gtn News Editorial, August,2014).

The card is made of polycarbonate material (Hartmann and Onyemenam, 2015). The National identity management commission adhered to a lot of International best practices when implementing the NIC. As such, the card meets the D-1 physical standard for all smart identity documents set by ISO/IEC-7810.

The card which measures 3.4 by 2.1 inches (see figure 2 below) also meets ISO/IEC 7810:2003 specification which outlines, the appropriate format for technology-enabled smart cards.



Figure 2. Front and Back view of the NIMC multipurpose card (Balogun, 2017).

The physical outlook on the NIC as illustrated above includes standard e-ID details as set by ISO/IEC 7501-3:2005 and endorsed by ICAO such as bearer photo, full name and issue date. Other features on the card include Date of Birth (DOB), the ten digit NIN referred to as unique document number above; Unique Euro pay MasterCard and Visa (EMV) primary account number (PAN), as well as the 3-line MRZ codes as defined by ICAO conventional passport inspection systems. According to Onyemenam (2014), the EVM on the card supports electronic payments which are in line with the country’s intention of going into the cashless economy and improving the business environments.

Furthermore, on the NIC is a unique chip design, which follows ISO/IEC norms such as: ISO 7816-1 (physical characteristics of integrated circuit cards), ISO 7816-2 (the dimensions and location of the contacts), ISO 7816-3 (Electronic signals and transmission protocols of integrated circuit cards), ISO 7816-10 (electronic signals and answer to reset for synchronous cards) and ISO 7816-12 (USB electrical interface and operating

procedures). The smart chip is contact based (NIMC, 2017). See Figure 3 titled: component of the NIMC e-ID below.

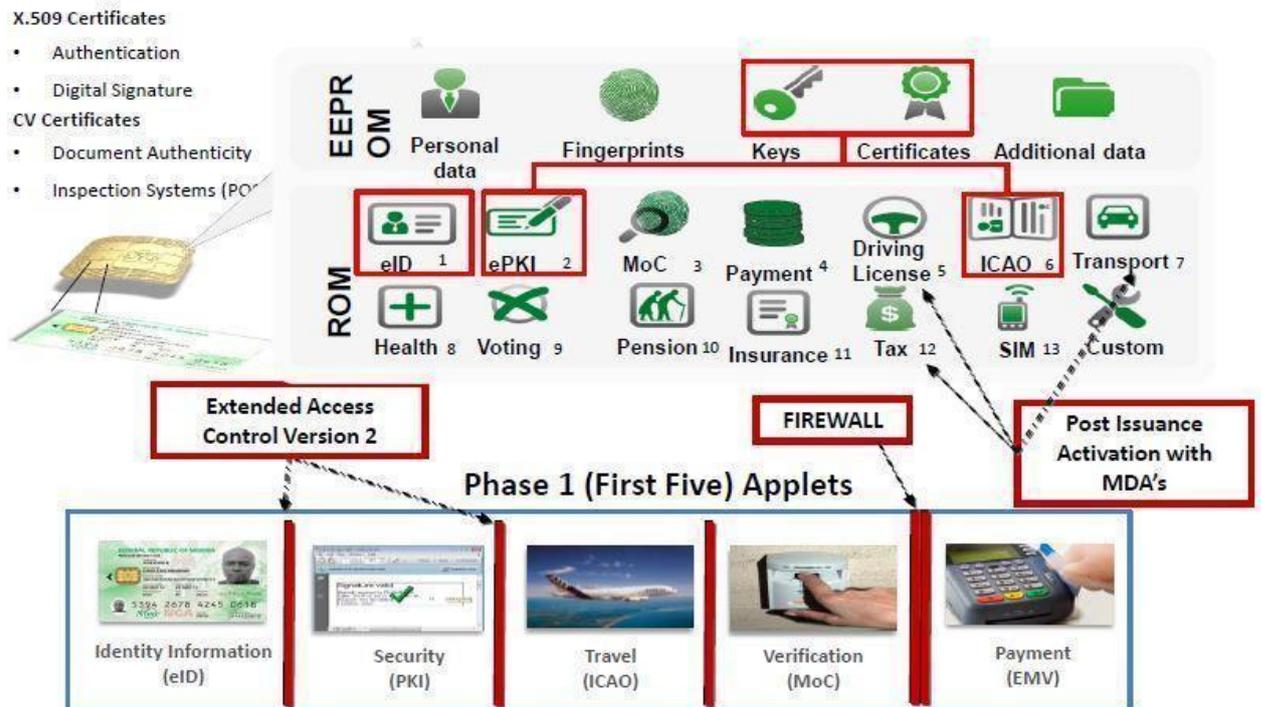


Figure 3. Component of the NIMC e-ID (Balogun, 2017).

Also, inside the chip is 13 in-built applets which offer a myriad of functions. These applets includes: e-ID (stores sensitive information like bearers address and fingerprints protected by Extended Access Control (EAC 2.0), e-PKI (allows the I-A-S function for “document signing, non-repudiation, encryption”), Moc (hold up 10 fingerprint details on an algorithm which solely runs within this app), EMV (allows e-payment via MasterCard), Driver’s License, ICAO (machine readable data according to ICAO Doc 9303 standard protected by Basic Access Control (BAC) for travelling in the ECOWAS region, as planned in the future), Transportation, Health, Voting and Sim (Hartmann and Onyemenam, 2015).

Upon collection of the card, the first five (5) applets are activated while the others such as such as the voting, pension, insurance and tax applications, is not yet operational. Also, as indicated in Figure 3 above, as well as backed with claims from the Commission (NIMC fact sheet, 2016), the applets are protected by a firewall with a double layer between MOC and EVM to prevent unauthorised access of private information by

MasterCard as well as any other third party. As 2016, NIMC was boasting of registering about 12.5 people, printing about 4.5m cards and issuing a total of 1m cards (Identity Ecosystem roundtable report, 2016).

3.4 Current state of identity management in Nigeria

Despite the huge commitments and efforts made by the Federal Government (FG) to put the NIC into full implementation, Anyim Pius Anyim a Nigerian politician who served as the President of Nigerian Senate and was the immediate past Secretary to the Government of the Federation expressed in an interview with Cyber Africa (cited in NICM Bulletin, 2016) that the project again lost track and went into dormancy. Consequently, he said that most agencies of the government, as well as commercial institutions, resulted to initiating their identification schemes. Elaborating more on this, Balogun (2017) confirms that about 13 or more Identity programs exist in the country at the Federal level and even more at the state level.

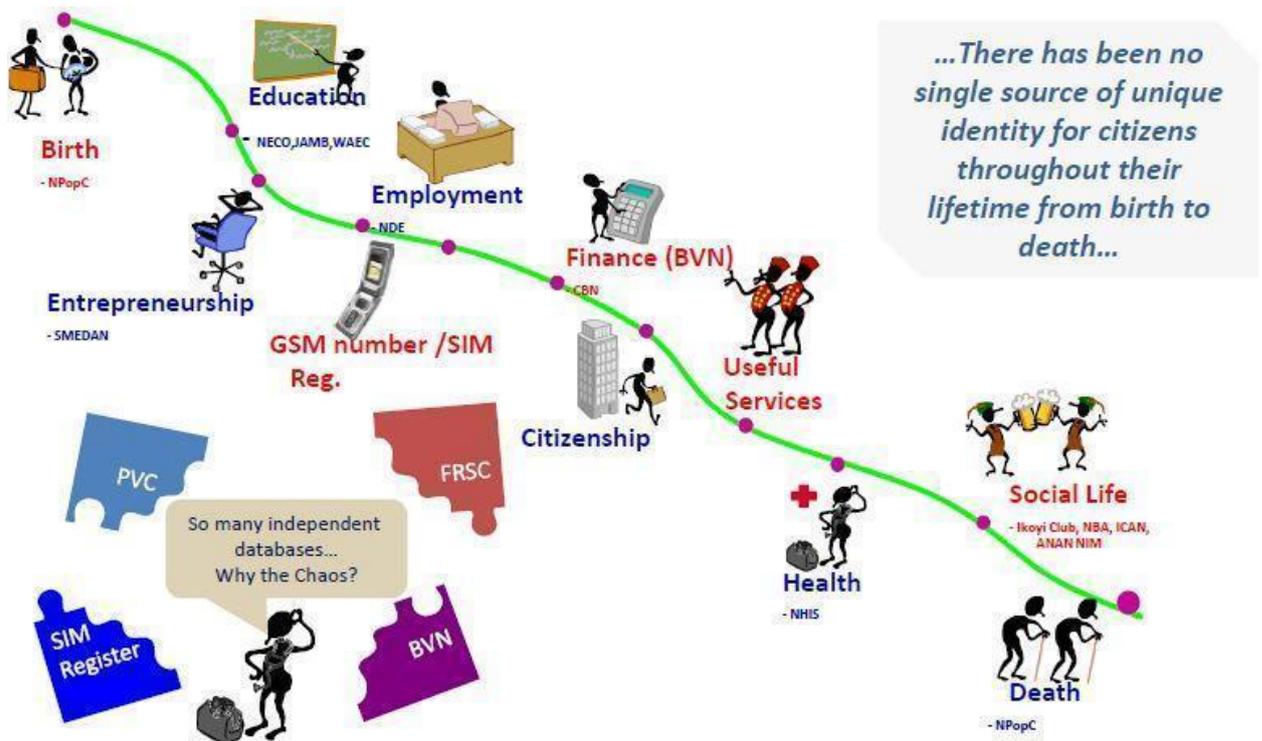


Figure 4. The current State of Identity Management in Nigeria (Balogun, 2017).

The image in Figure 4 illustrates the current chaotic state of affair in Nigeria. Most importantly, we can observe that there are many independent identity schemes in place. Some of which includes:

- The permanent voters card, (PVC) is a smart document issued by Independent National Electoral Commission (INEC, Nigeria) with biometric components such as fingerprints and facial image. These cards were issued ahead of the 2015 election to identify eligible voters (Nwagwu, 2015).
- Bank verification number (BVN) card is also a biometric card which contains 11-digit number, and it was mandated by the Central Bank of Nigeria in 2014 to be the universal ID in all banks in the country (Munis,2015), as part of the Know your customer (KYC) initiative to prevent identity theft in the banking industry.
- The National Health Insurance (NHIS) card allows enrollee access to health care service in a designated Primary Health Care Provider (PHCP) of choice (Maruf, Binuyo, Gambo, & Jimoh, 2016).
- National Youth Service (NYSC) Biometric ID helps in the general conduct of weekly and monthly check on corpsers (Vanguard, September 03, 2015).
- The National Driver's License card set by the Federal Road Safety Commission. According to Identity Ecosystem roundtable report (2016), FRSC has 140 offices with 179 enrolment stations, and it collects biometric data to issue driver's license).
- The identity card issued by National Pension Commission (PENCOM) for issuance of gratuity.
- Examination cards issued by the West African Examinations Council (WAEC), the National Examinations Council (NECO), Unified Tertiary Matriculation Examination (UTME).
- Identification schemes in entrepreneurship groups and National Association, such as Nigerian Military service, Nigerian Bar Association (NBA), the Institute of Chartered Accountants of Nigeria (ICAN) just to mention a few.

Aside from Identity cards, some other existing schemes in the country that mandates the collection of personal identification details and operates its identification database in isolation include:

- Compulsory Sim card registration established by Nigerian Communication Commission (NCC). Records from Identity Ecosystem roundtable report (2016) shows that NCC collected 110m records, and 38m records retained.
- National census conducted by National population commission (NPOPC).

According to a report by Identity Ecosystem of Nigeria (2016), FGN spent the sum of \$4.3b on identity cards in Nigeria in the year 2015. While the sum of \$1.2b was spent on ID programs, and another \$3.1b was recorded to have been spent on high cost due to fragmentation caused by managing different identity databases in isolation under separate government agencies (See figure 5 below) when it can all be uniformly run by NIMC.

... Future

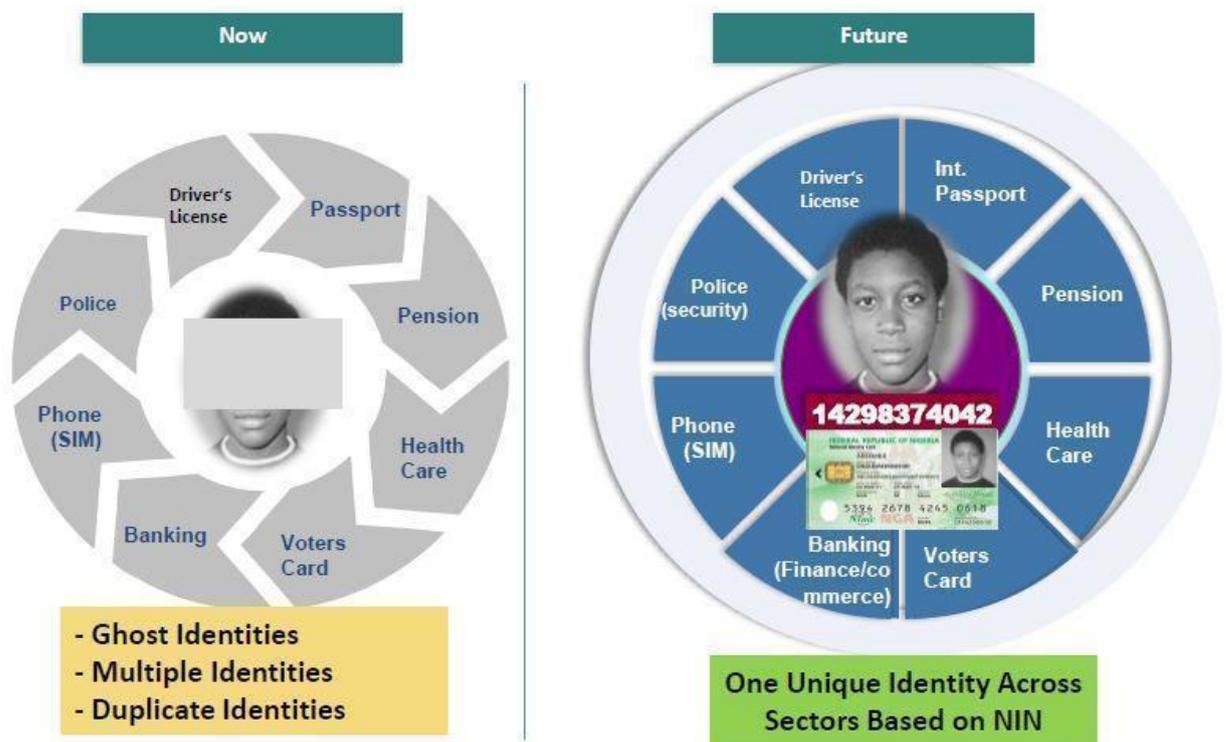


Figure 5. AS-IS and TO-BE Model of ID management in Nigeria (Balogun, 2017)

The good news, however, is that the Federal government in 2010 was keen about the enforcement of NIC and mandated Ministries Department and Agencies (MDA) to align their activities, especially regarding database management to that of NIMC as well as switch over to the use of NIC (NIMC, 2017).

Today some of these agencies have started realising the need to embrace the National Identification Number (NIN) issued by NICM as the sole identifier for eligible persons upon successful enrolment, therefore paving the way for a centralised system of identification in the country. More so, organisations like Banks and PENCOR, for instance, have started integrating the use of the NIC's into their administrative duties by allowing it to serve as an identification document while many others are working on harmonising their various independent databases with that of NICM (Olaleye and Agbota 2009).

Similarly, all agencies of the Federation are well represented in the harmonisation committee to fully integrate the NIN with their various administrative procedures. NIMC has also taken proactive steps towards this harmonisation process by deploying secure fibre connection to 14 agencies to ensure connectivity and seamless flow of data (NIMC, 2017). It is the hope of Nigerians that in the nearest future, the NIN would be used for all public service transactions in the country starting with the Federal government plan to use it for the upcoming 2019 elections. However, the Commission has openly expressed that there is inadequate funding to issue this new card to the bulk of registered Nigerians and a lack of infrastructural capacity necessary to successfully execute and manage the database (NIMC,2017).

3.5 Summary

As expressed in the introductory paragraph, chapter three was partitioned into three sections. The first part opened with a chronology of e-ID schemes in the country from its inception in 1967, to the introduction of the National Identity Scheme (NIMC) in 2007. The study then advanced to discuss in full details the technology enabled National Identity Cards (NIC) under NIMC's supervision. The chapter sums up its discussion with highlights on the current state of Identity Management in Nigeria under NIMC's watch. One of which is the open expression of the Commission about some of the challenges limiting the implementation of NIC in the country. Although much has been discussed regarding NIC in Nigeria, literature has remained inconclusive as there is no in-depth evidence to prove the challenges limiting the use of NIC in the country's public service.

Therefore, there would be a need to employ the use of primary data to discover what the actual problem is. Thus, the preceding chapter would introduce the methodology for the field survey.

4 Methodology

4.1 Introduction

Having concluded the last discussion on the basis that literature was inconclusive, therefore demanding the need to conduct empirical research, this chapter then centres on giving an account of the chosen design for the study as well as parameters and conditions under which this research is to be performed.

The chapter divides into four sections. The first part starts off by explaining what a case study research is, its advantages and limitations, as it is the chosen research design employed in this study. The section also draws our attention to the central objective of the study while explaining the rationale for choosing each research question and how it can help find answers to the overall research objective. The second part lays emphasis on document review and survey as both tools were utilised as the mode of data collection for the study. This is followed by section three which explains the reliability and validity assessment of the data collected and lastly the chapter closes with a summary of the entire discuss.

4.2 Case study research design

As discussed in Chapter one of this study, the central research objective is to find out as well as recommend means by which e-ID implementation can improve public service experience and interaction for the government (agencies and employees), businesses and citizens alike, in developing countries with the central focus on the Nigeria case. Based on the research objective, the case study research design was considered and employed as the appropriate research methodology for this study.

A case study is a design in which the researcher explores any of the following: an event, problem, process, activity, program, a single person or several individuals in depth, within a bounded system (usually time and /or space). However, this approach does not require a strict boundary between the object of study and its environment (Baran, 2016; Runeson et al.,2012; Soy, 2006). In addition, case study method “investigates a contemporary phenomenon within its real-life context”. This argument explains why strict boundaries

are not required in this method. Also, in such studies, the case is usually the core or centrepiece of the inquiry (Yin, 2003; Stake,1995).

There are different types of case study designs and they include; single, multiple or intrinsic case study, depending on the phenomenon under study. A single case study design usually focuses on an issue and then selects a bounded case to illustrate that issue. Multiple cases, on the other hand, is almost like single case design only that the researcher must select several bounded cases to illustrate the issue under study. Regarding intrinsic designs the researchers sets out to understudy a case without first focusing any issue (Runeson et al, (2012). Most research prefer working with single cases as it often selects a small geographical area or a very limited number of individuals as the subjects of study. One reason for this according to Hamel et al. (1993) and Yin (1994), is that this method focuses more on parameters, establishments and objectives of the research rather than a big sample size. It is in the light of this argument that we have also chosen to focus our study on the single case of e-ID implementation in Nigeria with the aim of providing a framework capable of improving the current system instead of investigating a wide range of cases of e-ID implementation in developing countries.

Case studies are commonly used research designs especially in areas such as “psychology, sociology, political science, social work, business, and community planning” where studies are conducted with the aim of not just increasing knowledge but also bringing about changes (Yin, 2013). Nonetheless, case studies do not produce the same results as other research designs, for example, causal relationship in experiments, but they provide a deeper understanding of the phenomena under study (Runeson et al.,2012,). There are different kinds of approaches to the use of case studies as well. For instance, Yin (1984) mentions three of them namely exploratory, descriptive and explanatory case studies. Hence, our research has adopted the use of exploratory case study design style.

According to Runeson et al., (2012), case study research is most often explorative by its very nature, it sets to investigate one or more research question which serves as a point of interest in the study (Yin, 2003; Robert, 2006), especially those phenomena which have not previously been researched. To achieve this, Soy (2006) argued that the first step to take is to establish firm research questions about the phenomenon under study which the researcher can refer to throughout the course of the research. In a similar argument, the

author believed the questions are often preceded by words like "how" or "why and they are mainly directed towards “limited number of event or conditions and their relationships” (Soy, 2006). Consequently, our study set out to explore the Nigeria case to find answers to the following research questions:

- **Q1. How can e-ID aid public service provision in Nigeria?**
- Q2. What are the current barriers to e-ID card usage in Nigerian public service?
- Q3. How best practices of e-ID management can be adopted in the Nigerian public service?

To this end, it was also relevant to discuss the importance of each of these questions to the study.

Question one here which is to discover how e-ID can aid public service provision in Nigeria was aimed at highlighting the major benefits of e-ID implementation in government administration particularly its relevance to public service as literature prove that the quality of public service is the key indicator of appraising all government actors. In addition, question two which is to investigate, the current barriers to e-ID card usage in the Nigerian public service was directed towards identifying factor limiting full implementation of NIC in the current government administrative systems. The aim here was to employ the root cause approach to better understand the problem.

The last question which is to recommend best practices of e-ID management that can be adopted to improve service interaction and user experience in the Nigerian public service was expected to proffer a practical framework capable of allowing full implementation of e-ID in the Nigerian public service environment for ease and better accessibility of service.

4.2.1 Advantages of using case study design

There are a lot of benefits for researchers who make use of case study design for their research. According to Yin (1984), one of such advantage is that data is examined in its natural environment. Unlike experiment designs where the phenomenon under study is deliberately isolated from its natural environment and put under strict conditions with a limited number of variables (Zaidah, 2003).

In addition to this, Yin (2009) and Tellis (1997) noted that another benefit of case study research is that it collects data from a wide range of sources. Examples are: documentation, archival records, interviews, direct observation, participant observation

and physical artefact. In respect to this, the design allows the use of both quantitative and qualitative data analysis, therefore, permitting the researcher to process the outcome of his/her study through complete observation, reconstruction and analysis (cited in Zaidah, 2007).

As a third advantage, Zaidah (2007) has confirmed that case studies research gives detailed qualitative account of a phenomenon in its natural environment and this helps to understand the complexity of this environment which in most cases is not captured through experimental or survey research.

4.2.2 Limitations of case study design

In spite of the many advantages of using case study research design, there has been much criticism about it. Yin (1984) draws our attention to three types of arguments to support this criticism. According to him, case studies research is mostly perceived to lack rigour. He emphasised this by noting that “too many times, the case study investigator has been sloppy, and has allowed equivocal evidence or biased views to influence the direction of the findings and conclusions” Yin (1984:21).

The next argument was that case study research is microscopic, and allows little support for scientific generalisation because they mostly make use of a small number of subjects, some research in this category are only conducted with one subject (Tellis, 1997;) as applicable in our study and this sort of situation makes it difficult for our research to generalise from the single case.

The last argument Yin (1984) made was that case study designs are often presumed difficult to conduct and demand a significant amount of documentation. This sort of style applies to case studies of ethnographic or longitudinal nature that permit a great deal of data over a period. According to Yin (1984) using this approach can be problematic if the data are not managed and organised systematically.

4.3 Method of data collection

In simple terms, a method of data collection is a technique used to collect empirical information in research (Tashakkori and Teddlie, 2003). When talking about the method of data collection in a research what often comes to play in the mind of the researcher is how to correctly choose the proper data gathering technique to accurately answer the research questions. Given this, Runeson et al., (2012) point out that Qualitative and Quantitative research methods are the two principal techniques often used by researchers for their studies and some of the major difference between them are expressed in Table (4) below.

Table 5: Difference between Qualitative and Quantitative research method

Qualitative Research Method	Quantitative Research Method
Evidence are analysed using categorization and sorting	Evidence are analysed using statistics,
Data is richer in what they may express	Data is more exact
Involves the use of words, descriptions, pictures, diagrams	Involve numbers and classes

(Runeson et al.,2012).

One major importance of case study research has over other research designs is its ability to employ multiple data from a wide range of sources which could be qualitative or quantitative technique or better still both together often called mixed methods (Tellis 1997; Seaman,1999). As a result, case study research collects data using tools like survey, interviews, documentation review and physical artifacts (Runeson et al.,2012,). This approach is valuable to researchers because it capitalises on the strength of the two techniques and helps in providing a holistic and in-depth explanation of the social and behavioural problems in the research questions (Creswell and Piano, 2007). On these grounds, our study has employed the use of document review and sample survey mode of data collection.

4.3.1 Document review

Examination of documents according to Yin (2009) is a data collection method that involves the basic overview of documents may include any of the following listed below or more.

- Letter, memoranda, email correspondence, and other personal documents, such as diaries, calendars, and notes;

- announcements and minutes of meetings and other written reports of events;
- agenda administrative documents like proposals, progress reports and other internal records;
- formal studies or evaluation of the same “case” that you are studying; and

news clippings and other articles appearing in the mass media or the community newspapers (Yin, 2009).

Also, Yin (2009) noted that document reviews are relevant evidence in case study research because they help in collaborating/augmenting data from other sources. In our study, we employed the use of many documents ranging from scholarly articles, government’s document, books to newspaper articles especially in our literature review where we had to discuss a lot of theoretical concepts. Our discuss addressed topics such as: identity document; e-ID and its component; examples of e-ID implementation in some advanced countries (Austria, Denmark, Estonia, Germany and Sweden) recognized by the UN to have excelled greatly in this area. Because of the need to show the progress of different countries in adoptin e-ID, the various unique approaches and peculiar problems they experience most especially those in developing countries which is the focus in this study. In addition to this, document review was also employed to give a more profound examination of the Nigerian case. For instance, the literature covered a historical antecedent of identity documents in Nigeria, just to help readers get familiar with the Nigerian system. Then we progressed to discussing the National Identity card (NIC, Nigerian National e-ID) to see if its meets up with current international standards and requirements. Finally, the document review ended on the note that there are barriers in the present system as the NIC has not been able to maximise its full potential in delivery public services. However, unavailability of theoretical evidence has made it difficult to determine the extent of this problem, therefore, creating the need to employ the use of empirical data using sample survey to support the claim.

4.3.2 Survey

The use of survey as a mode of data collection is one of the major research strategies used in case study designs after experiment and action research (Runeson et al.,2012,). It is defined as the collection of standardised information from a specific population or sample. In addition to this, survey requires pre-testing instruments, determining delivery methods, ensuring validity, and analysing results (The Pennsylvania State University,

2006). Therefore, researchers who conduct empirical studies using sample survey make use of instruments like interviews and questionnaires Roberts (2007) and Robson (2002). Additionally, the advent of the internet has expanded this options as researchers can now send a hyperlink of web survey to their respondent who can then self-administer it (Fricker & Schonlau, 2002).

4.3.2. 1 Research Approach

In our study, survey data will be collected using questionnaire as an instrument of data collection (see Appendix 1) and the structure of these questions will include a combination of both open-ended questions (allows respondent to express an opinion without influence) and close-ended questions (controls the respondent choice of answers) as proposed by (Urša Reja et al., 2003). The use of this two tactics is driven towards getting the right answers from the respondent.

Also, in light of the fact that the information we seek to discover about NIC and e-ID implementation in Nigeria is a privileged information, staff of National Identity Management Commission (NIMC), Wuse zone 5, Abuja, Nigeria was selected as our study population, considering that they are more knowledgeable on the e-ID implementation process in the country as well as its challenges. In addition to this, our choice of population have left us with only a few options of conducting survey due to the inability of the researcher to physically meet with respondents. However our study will employ web administered questionnaires as Wright (2005), have applauded the instrument for its ability to help access individuals in distant locations as well as participants who are difficult to contact.

Subsequently, the researcher narrowed down the study population using sampling technique. By sampling technique here we mean “the selection of a subset of a larger population” (Fricker & Schonlau, 2002). Usually, the need for sampling comes to play when the study population is very large like in our case, and when it is impossible for the researcher to sufficiently test all the individuals involved. Hence, we will be employing the use of expert sampling.

Like the name implies, experts sampling is a sub-type of non-probability sample where the opinions of experts are assessed due to the belief that they are professionals. By so stating, the researcher has sampled out staff in the following departments in NIMC:

- Research and Development department;
- Procurement Department;
- Database Department;
- Corporate service Department; and
- ICT department.

The reason for their selection is based on no other reason than their direct involvement in the ongoing e-ID Implementation and database harmonisation process in the country. In addition, the likelihood that the information coming from this group of individuals can be manipulated is very low.

4.4 Reliability and validity assessment of data

The use of reliability and validity is a common procedure in every standard research. It is used to determine the quality of a study (Patton, 2001). Consequently, we have carefully explained the reliability and the validity assessment of our study below.

4.4.1 Reliability

When referring to Reliability particularly in Quantitative Research, Joppe (2000) defines it as:

The extent to which results are consistent over time and also an accurate representation of the total population under study. In a similar argument, Kirk and Miller (1986) identified that reliability in quantitative research relates to any of the following three:

1. the degree to which a measurement, given repeatedly; remains the same
2. the stability of a measurement over time and
3. the similarity of measurements within a given period of time (pp. 41-42).

In respect to this, we could say that the use of questionnaire as a survey instrument in our study, connotes the type of stability defined above. Especially since Charlce (1995) expressed that the consistency with which questionnaire [test] items are answered or

individual's scores remain relatively the same can be determined through the test-retest method at two different times (cited in Golafshani, 2003). As a result, it is also right to conclude that the guarantee of stability provided in survey data using questionnaire automatically transcends reliability. This argument also supports Golafshani's (2003) claim that a high degree of stability indicates a high level of reliability, which means the results are repeatable.

4.4.2 Validity

About validity of research instrument, Joppe (2000) explains that it is that procedure that determines if the research has rightly measured that which it was intended to measure or how truthful the research results are.

In our study, construct validity and content validity was employed. The term construct here refers to the initial concept, notion, question or hypothesis that determines which data is to be gathered and how it is to be collected (Wainer and Braun,1998). Correspondingly, construct validity was used in our study to determine the appropriateness of inferences made on the basis of web survey.

4.5 Summary

This chapter gave a detailed description of case study design as it was the chosen methodology adopted for this study. Alongside its advantages and disadvantages. It also expressed that document review and web questionnaires were instruments to be used for data collection. While, the outcome of this field survey is expected to help gather credible and trust worthy answers to the research questions and the general objectives of this study. Also, reliability and validity assessment of the data collection instrument was also discussed. The findings of this exercise would also serve as the basis for discussion in Chapter five.

5 Presentation of results

5.1 Introduction

This chapter will present and analyse the outcome of the web survey conducted in this study. The use charts, graphs and percentage analysis was employed to describe the outcome of the web survey. It should also be noted that the statistical data presented in this chapter, form the basis upon which the findings were discussed in this chapter.

$$\text{Format: \%} = \frac{\text{No of responses}}{\text{Total no of respondents}} \times 100$$

5.2 Presentation of findings

Having carefully administered the instrument (Web Surveys) designed to investigate the problem under study; about (185) responses were generated. This constituted the data that is hereby analysed. In addition to this, the data was presented in four sections: A, B, C and D in line with the structure of the survey (see Appendix 1). While section A focused on knowing the general background of the respondent as a means of assessing the validity of their responses, the other sections centred on addressing substantial issues that are relevant to answering the research questions and achieving the overall research objectives. Subsequently, the analysis is then followed with an interpretation of the responses and an explanation for the observation.

5.2.1 Section A

This section gives details of the general information of the respondents and it addresses questions: 1-4.

- I. Question one was aimed at finding the ratio of the respondents according to their various departments.

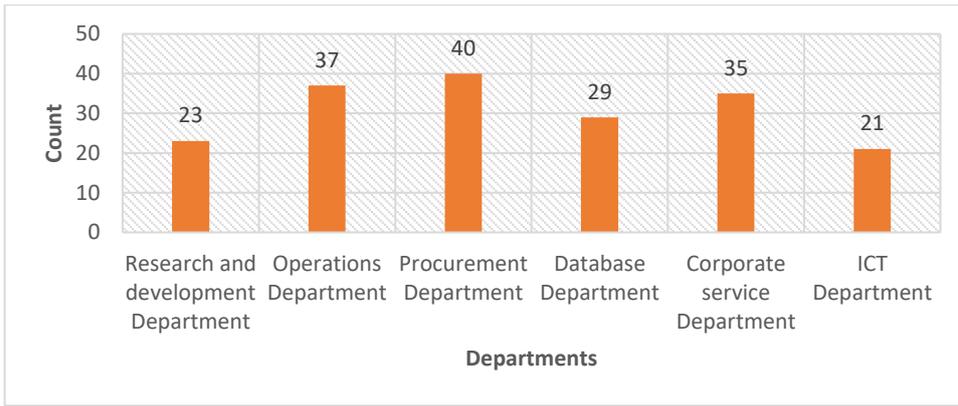


Figure 6. Distribution of Departments (Web Survey, 2017).

From the histogram above, (see Figure 6) we see the distribution of the (185 respondents) in the following order: Research and development department (23) respondents; Operations department (37) respondents; Procurement department (40) respondents; Database department (29) respondents; Corporate service department (35) respondents; and ICT departments (21) respondents. Thus, the data suggests a moderate level of responses from the various department listed, with staff of the Procurement departments coming out as the highest respondents.

II. Question two sought to identify the rank of each respondent so as to determine if survey was filled by experienced staff and this has been well expressed in the histogram below.

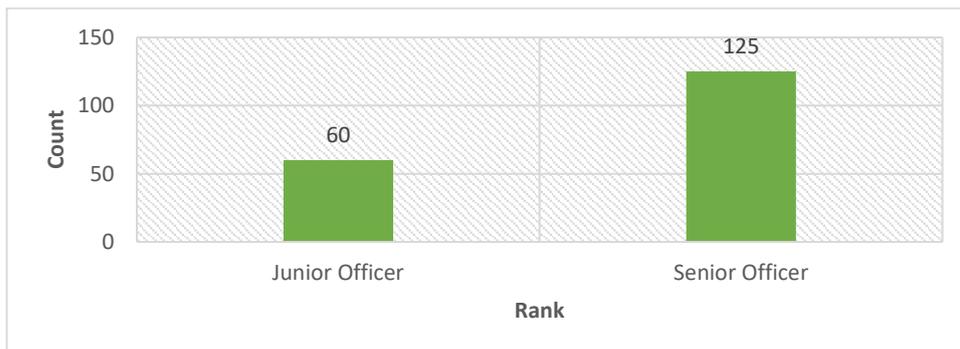


Figure 7. Distribution of respondent's Rank (Web Survey, 2017).

The responses were portioned into two categories. The first which was the distribution of junior officers was 32% (60 respondents), while the second category, which was 68% (125 respondents) were senior officers and this indicates that the bulk of our respondents were experienced staff.

III. Question three centered on identifying the number of working years of each respondent that filled the web survey, as a way of assessing their knowledge of the organization.

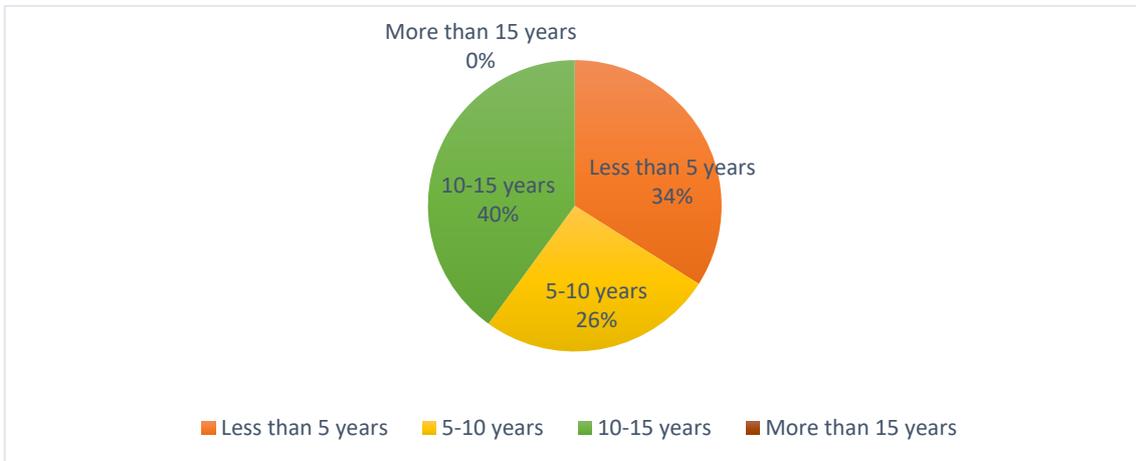


Figure 8. Distribution of Response according to Number of working Years (Web Survey, 2017).

As indicated in the Pie chart above (see figure 8), the replies were in the following order: 34% (63 respondents) shows the ratio of respondents who have worked less than 5 years in the commission; 26% (48 respondents) shows the ratio of those who have worked a couple of years longer, precisely between 5-10 years; 40% (70 respondents) represented respondents between 10-15 years in the commission. Hence the data gathered proves that majority of these respondents have stayed with the commission long enough to have the right answers to the questions we seek to know. Finally, the last category which is more than 15 years has no response and so does not have any representation in the chart.

IV. Question four was intended to capture the distribution of respondents qualification. The aim is to know if they are leaned enough to comprehend the survey questions and give reasonable answers.

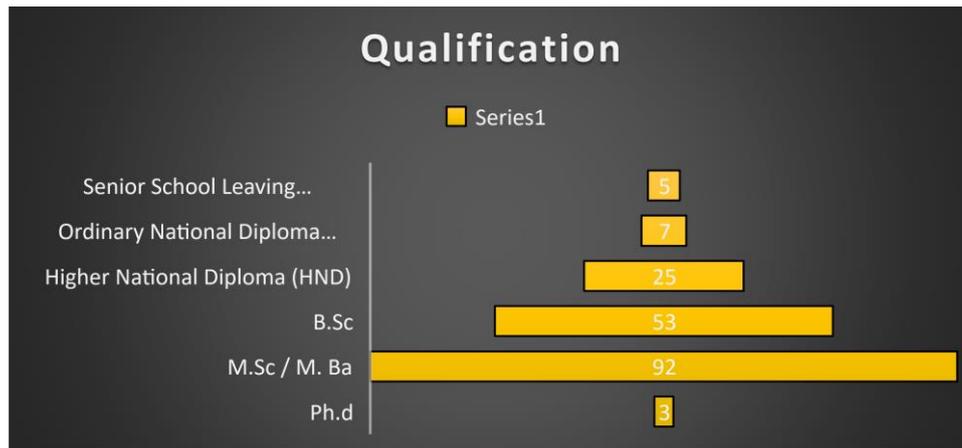


Figure 9: Distribution of Respondents Qualification (Web Survey, 2017).

The funnel chart above was used to relate this distribution in the following order: SSCE certification (5) respondents; OND certification (7) respondents; HND certification (25) respondents; B.Sc. certification (25) M.sc or M.ba certification (92); and Ph.D. certification (3) respondents. A closer look at the data indicates that most of these respondents have undertaken graduate degree programs and are certified (B.sc and M.sc). Therefore, they are well versed to answer the survey questions objectively.

5.2.2 Section B

This section answers the research question: “how can e-ID aid public service provision in Nigeria?” and it addresses question: 5-7.

- V. Since existing literature have proved that one of the major benefits of using e-ID in governemnt is for easy accessibility of public services online, question five was directed towards confirming if the Nigerian NIC (e-ID) was atleast designed to perform this action even if implementaton of this new cards is still on-going.

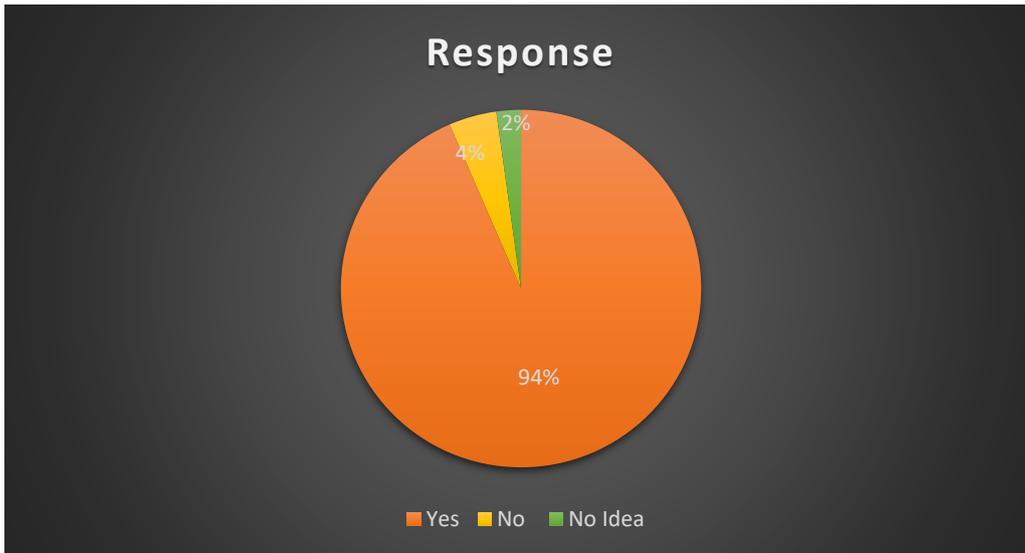


Figure 10: Distribution of Respondents reaction to question five

From the pie chart above we can see that respondents reacted to this question in the following order: 94% (173 respondents) agreed that the card is designed to allow access to essential public services 4.3% (8.0, respondents) disclaimed this fact while 2.2% (4.0 respondents) seemed not to have any idea about the subject matter.

VI. Given that the problem statement for this study clearly emphasised that bureaucratic delays in government offices is one of the major issues associated with assessing public services in Nigeria, question six was aimed at investigating if NIC would reduce this problem.

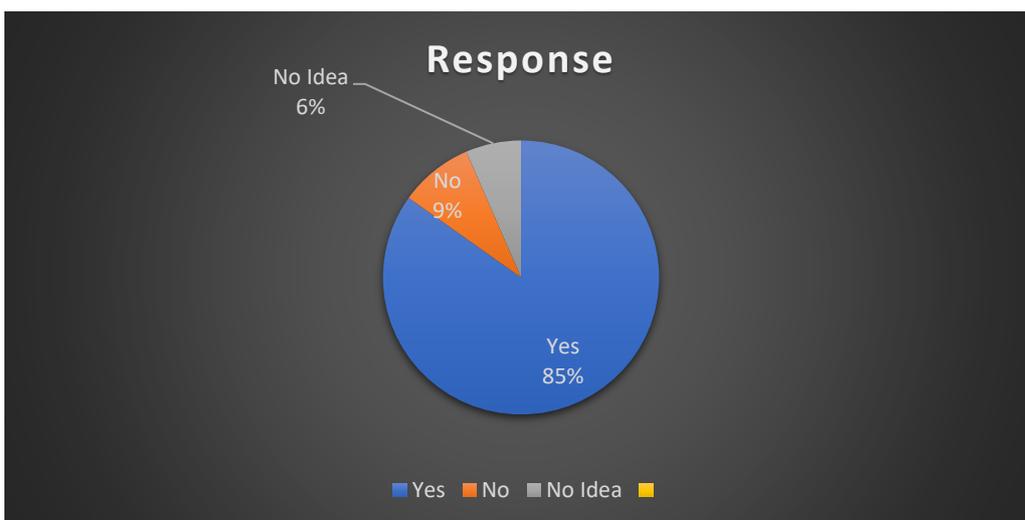


Figure 11: Distribution of respondent's reaction to question six

As indicated in the pie chart above respondents reacted in the following manner: 85% (157 respondents) agreed to NIC reducing this delay; 9% (16 respondents) disagreed; and 6% (12 respondents) seemed to have no idea about the subject matter.

VII. Question seven was aimed at discovering if full implementation of the NIC would mean that essential public services would be made available online, and can be applied for using the e-ID cards without the physical presence of the applicant?

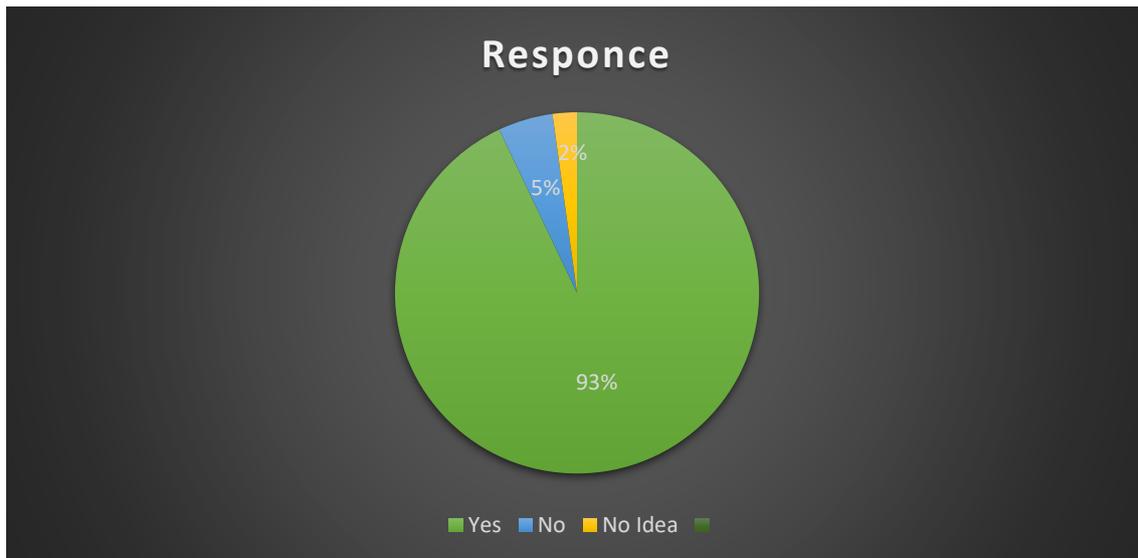


Figure 12: Distribution of respondents reply to Question seven

According to the pie chart respondents reacted to the question as follow: 93% (172 respondents) supported the idea; 5% (9.0 respondents) thought this was not the case; while 2.2% (4.0 respondents) did not have any idea on the subject matter.

5.2.3 Section C

This section answers the research question “**what are the current barriers to e-ID card usage in Nigerian public service domain?**” and it also addresses question: 8-9

VIII. Question eight was out to investigate if there was already any public service that can be accessed using NIC online?

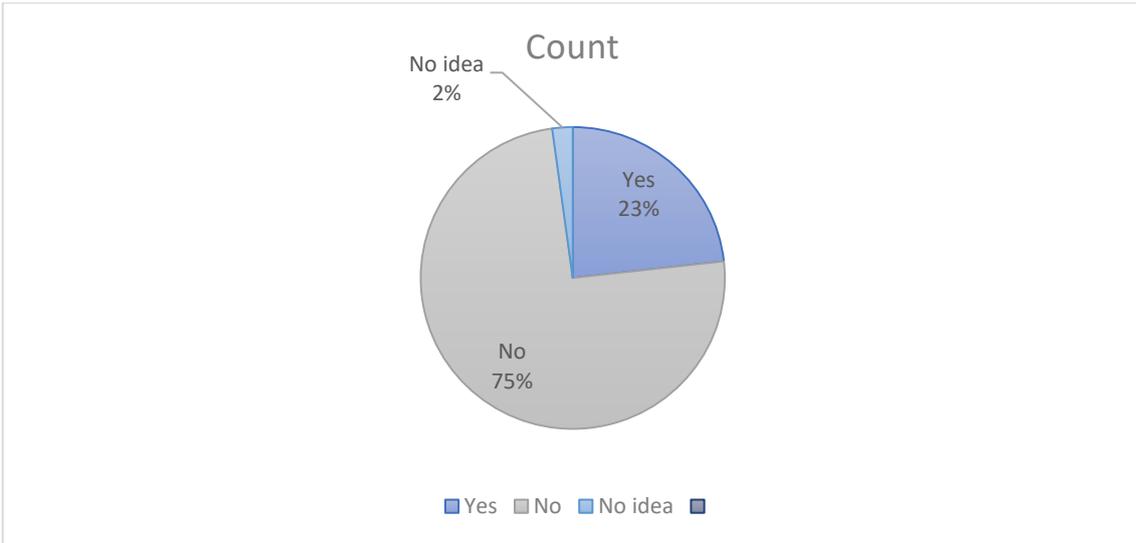


Figure 13: Distribution of response reply to question eight

As illustrated in the pie chart above, respondents gave the following answers: 75% (139 respondents) confirmed that there is no public service that can be accessed online for now; 23% (43 respondents) claimed that a few public services can; while 2% (4.0 respondents) seem not to have any idea of the subject matter.

IX. Since it was very obvious that there were certain barriers limiting the full implementation of NIC in Nigeria, question nine was driven towards discovering these impediments, taking cue from some of the common barriers to e-ID implementation in developed countries mentioned in chapter two of this study.

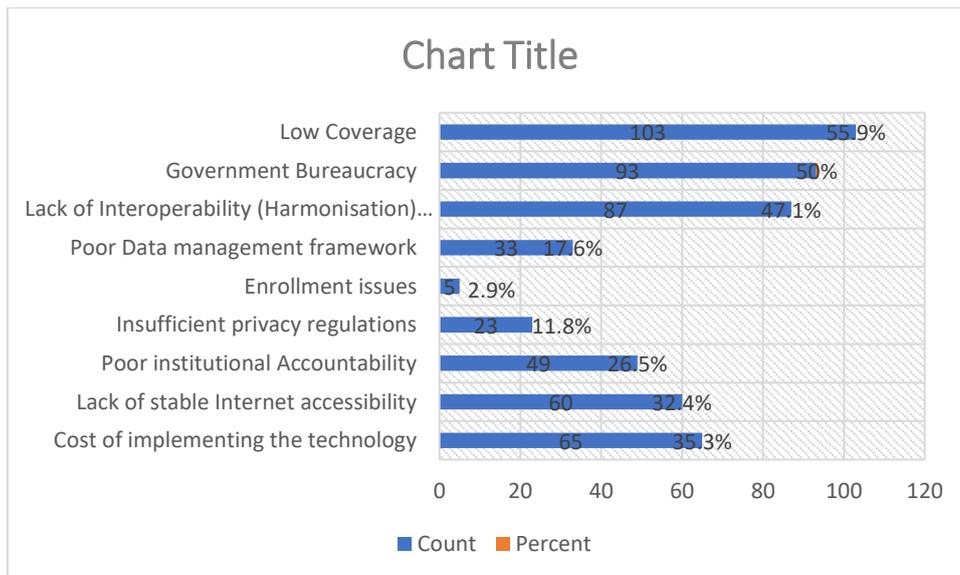


Figure 14: Barriers to e-ID implementation in Nigeria.

As indicated in the stacked bar above, the respondents agreed that these problems were also prevalent in Nigeria although the variations in percentage showed the seriousness of these problems. For instance, many of the respondents seemed to agree that low coverage of NIC, government bureaucracy, lack of interoperability, cost of implementing the technology and lack of stable internet accessibility were the most serious obstacles. While enrolment issues, insufficient privacy regulation, poor data management framework and poor institutional accountability were the least serious ones.

Furthermore, some respondents also mentioned that problems related to the Nigerian case:

- Political Instability.
- Lack of interest and unwillingness to support the project by the present government.

5.3 Summary of findings

This section gives a summary of the major findings in this research. It also explains how the research questions were answered and compares the results gotten with what has been done by other researchers.

The first research question and objective of this study was aimed at discovering “how e-ID can aid public service provision in Nigeria. A review of literature on this subject matter especially in countries where e-ID have been successfully implemented revealed that the technology brought much improvement in public services especially in areas of identification, accessibility and availability of essential services like primary health care, commerce, education and social services for entities. Bearing in mind the great role e-ID plays in developed nations both in Europe and the rest of the world, we decided to answer the research question by confirming if the technology had the same effect on a developing country like Nigeria and evidence from both document review and web survey disclosed the following:

- The NIC is designed to allow access to essential public services as well as foster the growth of digital culture in Nigeria. However, this has not been achieved as the government is yet to attain full implementation.

- The full implementation of NIC will help in improving public service accessibility consequently limiting the bureaucratic delays associated with public services in government offices in Nigeria as applicable in Austria, Demark, Estonia, Germany and Sweden;
- The full implementation of NIC would also mean that essential public services will be made available and accessible via a national online service portal. As an additional information, the researcher got hold of the fact that the Federal government has made provisions for this type of portal (see services.gov.ng) and it is being managed by the Federal Ministry of Communication Technology;

The second research objective and question was directed towards discovering “the current barriers to e-ID usage in delivering public services in Nigeria that hinders its full implementation. Although literature did not give us facts about problems hindering NIC implementation in the Nigerian public administrative system, it indicated that certain barriers were prone to e-ID implementation in developing countries. In our bid to answer the research question, we decided to use these barriers as yardstick for determining the problem with NIC enforcement in our survey. However, we gave room for more answers. As a result, findings confirmed that:

- No public service in Nigeria is accessible online using the e-ID authentication. To further ascertain the validity of this statement, the researcher got a user account in the services.gov.ng web portal and was amazed to discover that while a couple of services were accessible online for citizens, businesses and foreign residents, many of them took to using other means of authentication (SMS, ID numbers from their various ministries and email) instead of incorporating the user name and password for digital authentication on NIC. However, in the few cases where NIC is admissible, bearers are only expected to fill in details of the National Identity Number (NIN);
- Full implementation of NIC is hindered by low coverage of the card, government bureaucracy, lack of interoperability, cost of implementing the technology, lack of stable internet accessibility, enrolment issues, insufficient privacy regulation, poor data management framework and poor institutional accountability as predicted by studies from other researchers discussed in chapter two of this study. In addition, findings also discovered that political Instability and lack of interest

and unwillingness to support the project by the current administration were peculiar barriers in the Nigeria case.

The third objective and research question for this study focused on discovering best practices of e-ID management that can be adopted in the Nigerian public service Sdomain. To answer this question, findings from literature as shown in the example of the five countries reviewed (Austria, Demark, Estonia, Germany and Sweden) revealed that the following are some of the best practices needed for successful enforcement of e-ID in every country:

- Legal framework for privacy and data protection.
- Availability of e-ID infrastructure
- Adequate funding and
- Public-Private partnership.

In view of this, the preceeding chapter sets out to recommend a framework that would encourage full enforcement of NIC in Nigeria, inline with this practices.

6 Recommendations and conclusion

6.1 Introduction

In chapter five of this study, results of analysis proved that there are a lot factors limiting the full implementation of NIC in Nigeria. For this reason, this chapter aims to propose a practical framework for NICM and the Federal government of Nigeria. In addition, the chapter discusses in full details, the conclusion of this thesis and future work. In this light, section one would address the recommendations, section two focus on conclusions, while section three addresses future works.

6.2 Recommendations

After carefully reviewing the results from the web survey, as well as best practices of e-ID implementation amongst early adopters (Austria, Denmark, Estonia, Germany and Sweden) as discussed in chapter two of this study, the researcher came to a resolve that the Nigerian government needs to go back to the drawing board to re-establish the country's e-ID implementation plan. The researcher proposed a framework that will help speed up this implementation process in Nigeria as well as eliminate the current barriers common to identification and public service accessibility in the country. This framework includes a six-stage process (see figure 15 below).

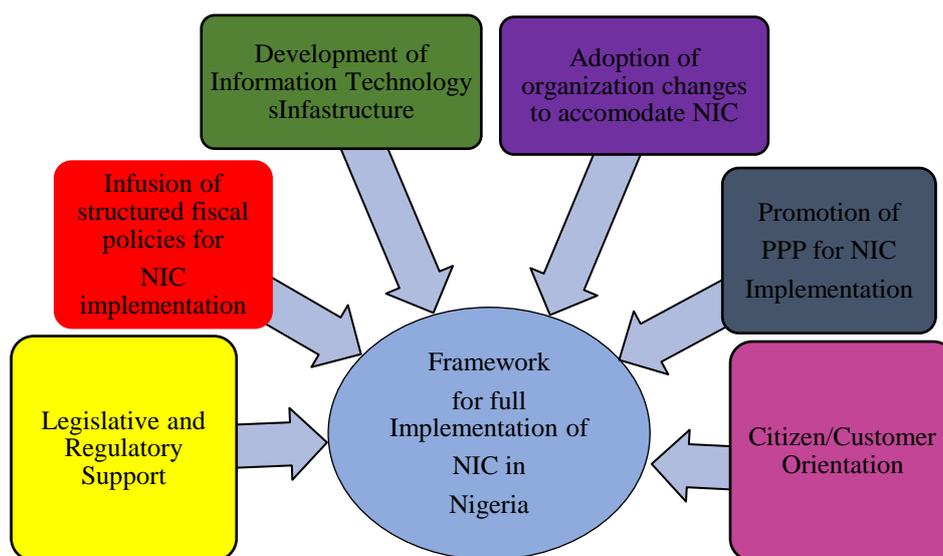


Figure 15. Framework for full e-ID implementation in Nigeria.

The following discussions will carefully explain each of this process in full details.

6.2.1 Legislative and Regulatory Support

It is important to note here that one of the issues with the use of e-ID in our world today is privacy and data protection. As a consequence, the first stage in this proposal is the enforcement of adequate legislative and regulatory support that would serve as deterrence to the abuse of privacy rights of persons, misuse of data by government and hostile third parties. These laws will also serve as a building block for integrating e-ID technology into the Nigerian public administrative system and governance at large. Therefore, the researcher has proposed that the government should amend or adopt the following laws:

- **Privacy law and data protection law:** Although chapter 23, section 37 of the constitution of the Federal Republic of Nigeria provides that "the privacy of citizens, their homes, correspondence, telephone conversations and telegraphic communications is hereby guaranteed and protected". This law by international standard can be considered inadequate, as it does not specifically and comprehensively state litigation measures against data theft of citizens and unofficial violation of private life by government agencies or hostile third parties. Hence, the government has to work on this law by amending the Act to meet the privacy and data protection needs of citizens given the current trends in technology and security in our world today.
- **Electronic signature:** At the moment, there is no statutory provision for electronic signature in Nigeria. What we have instead is the admissibility of electronic evidence in the courts provided by the evidence Act 2011. However, this is not enough as the country needs an electronic signature law to propel the use of digital signature and electronic transactions such as e-services in the country. In that wise, the Nigerian government should consider updating the country's constitution to include an e-signature law that will define what is acceptable and how it can be adopted easily by the citizens. In addition, there should be corresponding policies mandating entities to accept digitally signed documents for administrative procedures.
- **Electronic communication act:** This law is also vital for the full implementation of NIC in Nigeria. Reasons beign that it would help aid communication and data flow amongst MDA's and NIMC. Also, this law can also help imbibe the culture of the once only principle in the country discussed in chapter two of this study.
- **Law on elimination of paper in all MDA's:** This is an important aspect which

must be worked on and if adopted will aid automation of processes in all government offices in the country.

Finally, it is important to enforce these laws centrally and make them technology neutral as applicable in the case of Estonia to allow continuity and reusability when a new technology emerges.

6.2.2 Infusion of structured fiscal policies for NIC implementation

With regards to the problem of funding and slow production of NIC mentioned in chapter three of this study and confirmed by the Web survey conducted, there would be a need to make solid and stable provisions for full e-ID implementation in Nigeria so as to sustain the continuity of the e-ID project as well as meet expected end results regardless of change in governance. In view of this we would propose that Nigerians and foreign residents should be made to pay a fee while applying for their NIC as this would help to reduce the financial burden on the government for providing the cards. In addition, no other provision should be made for an elaborate ID in any other MDA other than NIMC and government funds should be directed towards providing free e-ID software for developers and citizens, managing the database as well as ICT infrastructure involved in the implementation process of NIC and e-governance at large.

6.2.3 Development of Information Technology Infrastructure

The enforcement of NIC in Nigeria is at a slow pace because of technical and operational difficulties some of which includes; lack of required equipment needed for implementation, network and server malfunctions and finally the poor usability of the government service portals and e-solutions. To address these problems there is the need to place a lot of emphasis on the access to components such as networks (internet), digitalized data and the authentication system (e-ID and PKI) in all MDA's as well as interoperability infrastructure for data exchange. This proposal comes because of the success story of the X-road system and other infrastructural provisions put together by the Estonian government as the country has been able to amass a huge value of big data and high availability of services while maintaining user and data confidentiality and integrity during such process.

6.2.4 Adoption of organization changes to accommodate NIC

The enforcement of e-ID in a country can only be successful when there is an organized structure on ground to support the system. This is in contrast with the practice in Nigeria. As available evidence show that the government run multiple identification systems under the different MDA's in the country. Thus, hindering the full implementation of the NIC. As such, there is a cogent need to mandate the use of the card for accessibility of all public services in the country. Additionally, this approach should be applied to all forms of payments or remuneration such as benefits, salaries, stipends, grants, government contracts and procurements.

6.2.5 Promotion of PPP for NIC implementation

A successful implementation of the NIC in Nigeria should involve cooperation among the public and private sectors. This framework encourages the Nigerian government to continue with its culture of outsourcing the country's e-ID project and service delivery to private companies when necessary. However, one important point to be noted is that these companies should be based in the country as this would help in supporting business and innovation in the Nigerian local market. The implementation plan should also involve more Nigerian banks to prevent monopolisation of the e-ID system by Access Bank Nigerian Plc (the only banking partners in the implementation committee). Similarly, the government should properly make sure that these projects are well supervised to ensure the quality of the services provided and accountability.

6.2.6 Citizen/customer orientation

The last stage in this frame work will be to encourage the creation of awareness for residents at all levels of government. There is a great need for the Federal government to provide necessary ICT education and training to Nigerians about the benefits of the NIC for easy adoption.

6.3 Conclusion

This study was aimed at analysing the role of e-ID in enhancing public service effectiveness in developing countries, as the technology has become a de facto standard (Lin & Zhou, 2015), and has gained quite a lot of popularity in the world today.

To fully understand the subject matter, the researcher took to defining the concept e-ID in chapter two of the study. The research also went ahead to clarify what a standard national e-ID system should look like by taking into cognisance all the ISO/IEC standards and best practices. In addition, a detailed summary of e-ID implementation plan in five EU countries (Austria, Denmark, Estonia, Germany and Sweden) with high OSI index (EGDI, 2016) was included. Therefore, providing idea of what a successful system should look like. The researcher also made sure to investigate common barriers to successful e-ID implementation in developing countries to gain some level of familiarity with these problems and look out for them in the case study.

Nigeria was selected as the case study for this research because available evidences indicated that the government of the country has difficulties in delivering public services to her citizens and legal resident in a non-discriminatory manner despite the presence of a national e-ID scheme. Hence, the study was interested in finding out how this technology could aid public service provision in Nigeria, what the current barriers to NIC usage in the Nigerian public service domain were and best practices of e-ID management that could help the Nigerian government out of this situation.

In this view, the major findings from our research proved that the Nigerian national Identity card (NIC) is still going through an implementation phase and result shows that the card has not been fully integrated into the public service delivery system. The studies also revealed that NIC is a standard e-ID that meets all the guidelines set by ISO/IEC for smart e-ID's. The card was designed to allow access to public services online via the service portal [www. services.gov.ng](http://www.services.gov.ng), and full implementation will put an end to the bureaucratic delays currently associated with public services in Nigeria.

Furthermore, findings provided confirmatory evidence that the barriers prone to e-ID implementation, discussed in chapter two such as: low coverage of the card, government bureaucracy, lack of interoperability, cost of financing the technology, lack of stable internet accessibility, enrolment issues, insufficient privacy regulation, poor data management framework and poor institutional accountability as predicted by studies from other researchers were also prevalent in the Nigerian case. What's more, political Instability, lack of interest and unwillingness to support the project by the current

administration were discovered to be peculiar barriers to the NIC implementation in the Nigeria. For this reason, the researcher has proposed a six-stage implementation framework for the Federal government of Nigeria and NICM as panacea to the present challenges and help achieve full e-ID implementation in the country. Knowledge for this framework was established from the e-ID implementation for Austria, Denmark, Estonia, Germany and Sweden, which was discussed in the chapter two of this study. The processes involve: setting legislative and regulatory support for the use of NIC in Nigeria, infusion of structured fiscal policies for the sustainability of the system, development of IT infrastructure, adoption of organisational changes to accommodate NIC, promotion of PPP for NIC implementation and citizens /customer orientation.

This study has shown that e-ID has a great role to play in enhancing public service effectiveness developing countries; e.g. Nigeria just like its contemporaries in the advanced world. Correspondingly, the study also supports Clark (1994); OECD (2003); World Bank (2015); Castro (2011) arguments that e-ID facilities government and commercial transactions and can guarantee high-quality and cost-effective user-centric services in public administrative system, and the technology is valuable to both government (G2G) business (G2B) and citizens (G2C).

6.4 Future research

In the course of writing this Masters thesis, a couple of study areas have been identified for possible future works. As such, the researcher calls for further studies on the development of an interoperability model or framework suitable for data exchange and communication in the Nigerian public service domain. Another research possibility is the study of how Big data generated from the use of e-ID can be exploited to help solve money laundering, theft and criminal issues in the country. Since such data will provide government with the proper statistics for resource allocation as well as proper planning and implementation of welfare for citizens.

7 Bibliography

- Alshehri, M. A., & Drew, S. (2010). *Implementation of e-Government: Advantages and Challenges*. Proceedings of the IASK International Conference E-Activity and Leading Technologies & InterTIC 2010 - See more at: <https://research-repository.griffith.edu.au/handle/10072/40620#sthash.yQJkfU7a.dpuf>
- Anderson, C. L. (2015). *Review of National Identity Programs* Pierre Biscaye, Sarah Coney, Eugenia Ho EPAR Request No. 306 Brian Hutchinson, Mia Neidhardt C. Leigh Anderson & Travis Reynolds Prepared for the Focus Group on Digital Financial Services of the International Telecommunication Union and the Financial Services.
- Adriano, E. A. Q. (2015). The Natural Person, Legal Entity or Juridical Person and Juridical Personality. *Penn St. JL & Int'l Aff.*, 4, 363.
- Ashforth, B. E., Harrison, S. H., & Corley, K. G. (2008). Identification in organizations: An examination of four fundamental questions. *Journal of management*, 34(3), 325-374.
- Baran, M. L. (Ed.). (2016). *Mixed Methods Research for Improved Scientific Study*. IGI Global.
- Berdah, J. F. (2006). *Citizenship and National Identity in France from the French Revolution to the Present*. Edizioni Plus.
- Bhatnagar, S. C. (2014). Public service delivery: role of information and communication technology in improving governance and development impact. ADB Economics Working Paper Series, (391).
- Cap, C. H., & Maibaum, N. (2002). Digital Identity and its Implication for Electronic Government. In *Towards the E-Society* (pp. 803-816). Springer US.
- Clancy, T. C., Kiyavash, N., & Lin, D. J. (2003, November). Secure smartcard based fingerprint authentication. In *Proceedings of the 2003 ACM SIGMM workshop on Biometrics methods and applications* (pp. 45-52). ACM.
- Clarke, R. (1994). Human identification in information systems: Management challenges and public policy issues. *Information Technology & People*, 7(4), 6-37. MCB UP Ltd.

- Castro, D. (2011). Explaining International Leadership: Electronic Identification Systems. *Information Technology and Innovation Foundation*.
- Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research. Thousand Oaks, Calif: Sage.
- Czaja, R., & Blair, J. (2004). Designing surveys: A guide to decisions and procedures. Pine Forge: Sage.
- Ducastel, N. (2015). *International Comparison of e-ID Means*. PBLQ Report, Government of Netherlands – See more at: <https://www.government.nl/documents/reports/2015/05/13/international-comparison-eid-means>. Retrieved at 07-01-2017
- EC. (2016). European Digital Progress Report: *Digital Public Services*. See more at: <https://ec.europa.eu/digital-single-market/en/digital-public-services-scoreboard>. Retrieved 12-12-2016.
- EC. (2005). Modinis study on Identity management in e-government: Deliverable 3.11 Workshop Report (1st-4th May). See more at: https://www.cosic.esat.kuleuven.be/modinis-idm/twiki/pub/Main/ProjectActivities/modinis.D3.11_First_Workshop_Report.1.1.pdf. Retrieved 04-12-2017.
- EC. (2013). *Feasibility study on an electronic identification , authentication and signature policy*. See more at: <http://doi.org/10.2759/25928>. Retrieved 08-09-2016.
- Explorable.com (Jul 21, 2009). Population Sampling Techniques. See more at: Explorable.com: <https://explorable.com/population-sampling>. Retrieved 03-22-2017.
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative inquiry*, 12(2), 219-245.Sage.
- Fricker, R. D., & Schonlau, M. (2002). Advantages and disadvantages of Internet research surveys: Evidence from the literature. *Field methods, Sage Journals*, 14(4), 347-367. See more at: <http://doi.org/10.1177/152582202237725>. Retrieved 16-04-2017.
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), 597-606. See more at: <http://nsuworks.nova.edu/tqr/vol8/iss4/6>. Retrieved 22-02-2017
- G T. New editorials. (2014). *13m Nigerians to Receive Electronic ID Cards with Payments functionality*. See more at: <https://www.gtnews.com/2014/08/29/13m->

- nigerians-to-receive-electronic-id-cards-with-payments-functionality/Retrieved, 10-03-2017.
- Hartmann, M & Onyemenam, E. (2015). Nigeria's new ID card - based on ICAO standards: *Many Nigerian lack proven identity*. See more at: https://www.hjp-consulting.com/sites/default/files/pdfs/Infosecura_66_Nigerian-ID-Card_p16-17.pdf Retrieved, 10-03.2017.
- Hamel, J., Dufour, S. and Fortin, D., (1993). *Case Study Methods*. Newbury Park, CA: Sage Publications.
- Hendry, M. (2007). *Multi-application smart cards: technology and applications*. Cambridge university press.
- Khatchatourov, A., Laurent, M., & Levallois-Barth, C. (2015, August). Privacy in Digital Identity Systems: Models, Assessment, and User Adoption. In *International Conference on Electronic Government* (Vol. 4, pp. 273-290). Springer international publishing See more at: <http://doi.org/10.1007/978-3-319-22479-4>. Retrieved 30-04-2016.
- Kodl, J., & Lokay, M. (2001). Human Identity, Human Identification and Human Security. *Biometric System for Generating of Non-transferable Private Keys*. Proceedings of the Conference on Security and Protection of Information, 129–138.
- Kornum, N., Gyrð-Jones, R., Al Zagir, N., & Brandis, K. A. (2017). Interplay between intended brand identity and identities in a Nike related brand community: Co-existing synergies and tensions in a nested system. *Journal of Business Research*, 70, 432-440. See more at: <http://doi.org/10.1016/j.jbusres.2016.06.019>. Retrieved 16-12-2017.s
- Lin, D., Young, M., & Zhou, J. (2015). *Information Security and Cryptology: 10th International Conference, Inscrypt 2014, Beijing, China, December 13-15, 2014, Revised Selected Papers* (Vol. 8957). Springer.
- Lyon, D. (2005). The border is everywhere: ID cards, surveillance and the other. *Global surveillance and policing: Borders, security, identity*, 66-82.
- Lyon, D. (2009). *Identifying citizens: ID cards as surveillance*. Polity.
- Lyon, D. (2011). Identifying Citizens: ID Cards as Surveillance. *British Journal of Sociology*. Polity. See more at: http://doi.org/10.1111/j.1468-4446.2011.01389_7.x. Retrieved 16-05-2016.

- Melin, U., Axelsson, K., & Söderström, F. (2013). Managing the Development of Secure Identification-Investigating A National e-ID Initiative Within A Public e-Service Context. In *21st European Conference on Information Systems, June 5-8, 2013, Utrecht, The Netherlands*. See more at: <http://doi.org/10.1108/TG-11-2013-0046>. Retrieved 29-09-2016.
- Munis, V.O, (2014). CBN introduces bank verification numbers in Nigeria. See more at: http://www.trlplaw.com/wp-content/uploads/2015/04/CBN_introduces_bank_verification_numbers-1.pdf, Retrieved, 10-03-2017
- Nguyên, T. L. (2003). *National Identification Systems* (Doctoral dissertation, Massachusetts Institute of Technology).
- Nwangwu, C. (2015). Biometric voting technology and the 2015 General Elections in Nigeria (pp. 1–28). Abuja. See more at: <http://www.inecnigeria.org/>. Retrieved 09-12-2016.
- OECD. (2003). *OECD e-Government Studies, The e-Government Imperative*. Organisation for Economic Co-operation and Development. See more at: <http://doi.org/10.1787/9789264101197-en>. Retrieved 04-09-2016.
- OECD. (2010). Denmark, Efficient E-government for Smarter Public Service Delivery. *OECD E-Government Studies*, 1 online resource (302 p.). See more at: <http://doi.org/10.1787/9789264087118-en>. Retrieved 06-07-2016.
- Oladimeji, L. A., & Said, H. U. (2012). Public Service and Poverty Eradication in Nigeria: An Assessment of National Poverty Eradication Programme (NAPEP), 2001-2011. *Public Administration Research*, 1(1), 94–102. See more at: <http://doi.org/10.5539/par.v1n1p94>. Retrieved 07-08-016.
- Oyedele, S. O. (2015). The Nigerian Public Service Under Civil Rule. *Journal of Public Administration, Finance and Law*, (7), 33. See more at: http://www.jopaf.com/uploads/issue7/jopaf_issue7.pdf#page=33. Retrieved 06-07-2016.
- Patton, M. Q. (2002). *Qualitative evaluation and research methods* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Poller, A., Waldmann, U., Vowé, S., & Türpe, S. (2012). Electronic identity cards for user authentication-promise and practice. *IEEE Security & Privacy*, 10(1), 46-54. See more at: <http://doi.org/10.1109/MSP.2011.148>. Retrieved 09-09-2016.

- Reja, U., Manfreda, K. L., Hlebec, V., & Vehovar, V. (2003). Open-ended vs. close-ended questions in web questionnaires. *Developments in applied statistics*, 19(1), 160-117. FDV.
- Robson, Colin. "Real world research. 2nd." Edition. *Blackwell Publishing. Malden* (2002).
- Runeson, P., & Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. *Empirical software engineering*, 14(2), 131. Springer. See more at: <http://doi.org/10.1007/s10664-008-9102-8>. Retrieved 05-07-2016.
- Stake, R. E. (1995). *The art of case study research, Perspective in Practice*. London: Sage.
- Schuppan, T. (2009). E-Government in developing countries: Experiences from sub-Saharan Africa. *Government Information Quarterly*, 26(1), 118–127. See more at: <http://doi.org/10.1016/j.giq.2008.01.006>. Retrieved 10-08-2016.
- Soy, S. K. (1997). The case study as a research method. *Unpublished paper, University of Texas at Austin*, 1-6.
- Seaman, C. B. (1999). Qualitative methods in empirical studies of software engineering. *IEEE Transactions on software engineering*, 25(4), 557-572.
- Siddhartha Arora, & Ganley, D. M. (2008). *National e-ID Card Schemes :An overview*. Royal Holloway University of London. See more at: http://cdn.ttgmedia.com/searchSecurityUK/downloads/RH4_Arora.pdf. Retrieved 20-07-2017.
- Smith, T. W. (1987). The art of asking questions, 1936-1985. *The Public Opinion Quarterly*, Vol.51(Part 2: Supplement: 50th Anniversary Issue), 51, S95-S108.
- Tanis, M., & Beukeboom, C. J. (2011). Organizational identification and the communication of identity: Effects of message characteristics on cognitive and affective identification. *British Journal of Social Psychology*, 50(4), 784-791. See more at: <http://doi.org/10.1111/j.1468-0297.2011.01611.x>. Retrieved 06-10-2016.
- Tellis, W. M. (1997). Application of a case study methodology. *The qualitative report*, 3(3), 1-19. See more at: <http://www.nova.edu/ssss/QR/QR3-2/tellis1.html>. Retrieved 23-02-2017.
- Vassil, K. (2015) Estonian e-Government Ecosystem. Foundations, applications, outcomes. Case Study for the World Development Report 2016. Institute of Government and Politics, University of Tartu, pp.2-37.

- Visser, W., & Twinomurinzi, H. (2009). E-Government & Public Service Delivery: Enabling ICT to put “People First”—A Case Study from South Africa. *Journal of Systemics, Cybernetics & Informatics*, 6(6), 36-41. See more at:<http://www.iiis.org/cds2008/cd2008sci/PISTA2008/PapersPdf/P476DK.pdf>. Retrieved 04-03-2017
- Wainer, H., & Braun, H. I. (1988). Test validity. Hilldale, NJ: Lawrence Earlbaum Associates.
- Wright, K. B. (2005). Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of Computer-Mediated Communication*, 10(3), 00-00.
- Yin, R.K., (1984). Case Study Research: Design and Methods. Beverly Hills, Calif: Sage.
- Yin, R. K. (1994). Case Study Research: Design and Methods (Beverly Hills, CA., Sage).
- Yin, R., (2003). Case Study Research: Design and Methods, 3rd edition. Sage.
- Yin, R. K. (2013). *Case study research: Design and methods. Second Edition* (Vol. 5). London, New Delhi: Sage.
- Zainal, Z. (2003). An investigation into the effects of discipline-specific knowledge, proficiency and genre on reading comprehension and strategies of Malaysia ESP Students. *Unpublished Ph. D. Thesis. University of Reading*.

8 Appendix 1 -Web Survey

Dear Participant,

REQUEST FOR COMPLETION OF QUESTIONNAIRE

I am a Masters student of e-Governance Technologies and Services at Tallinn University of Technology in Estonia. I am conducting a research study on *the role of e-ID in enhancing Public Service effectiveness in developing countries: The Nigerian case*.

The questionnaire attached is intended to help me obtain vital information for the research.

Kindly answer each question to the best of your knowledge. Your responses will be kept in strict confidentiality as it is only for academic work.

Thank you very much.

SECTION A: GENERAL INFORMATION

Please complete the following questionnaire items in each section by ticking () in the ebrackets or fill the most appropriate category that best represents your opinion

(1) Specify Department:

.....

(2) Specify Field of expertise:

.....

(3) Note number of working years in field of expertise:

Less than 5 years () 5-10 years () 10- 15 years () More than 15 years ()

(4) Educational Qualification:

SSCE () OND () HND () B.Sc. () M.Sc. () P. HD ()

SECTION B: Please tick "Yes or No "or "No idea."

How can e-ID aid public service provision in Nigeria?

5. Can you confirm that the National Identity Card (NIC) is designed to allow Nigerians and foreign residence easy access to essential public service (Medicare, Health Insurance, Voters registration and their likes) in the country?

Yes () No () No idea ()

6. Do you think the use of the National e-ID would reduce the current bureaucratic delays often associated with accessing government services in ministries and government offices in Nigeria today?

Yes () No () No idea ()

7. In your opinion, would you agree that if this card is fully implemented, some essential public services would be made available online, and can be applied for using the e-ID cards without the physical presence of the applicant?

Yes () No () No idea ()

SECTION C

What are the current barriers to e-ID card usage in Nigerian public service?

8. Can you confirm if this card can already be used to access public services online?

Yes () No () No idea ()

9. If No can you assert by ticking that the challenges mentioned below are some of the factors limiting the National E-ID card usage in Nigeria. You can tick as many options as possible.

S/no	Question	Yes	No	No idea
A	Cost of implementing the technology			
b	Lack of stable Internet accessibility			
C	Poor institutional Accountability			
d	Lack of privacy regulations			
E	Enrolment issues			
F	Poor Data management framework			
G	Lack of Interoperability (Harmonisation) framework			
h	Government Bureaucracy			

Please mention others here.....

