Identity Management for e-Government
Libya as a case study

Othoman ELASWAD, Christian Damsgaard JENSEN
Department of Applied Mathematics and Computer Science,
Technical University of Denmark, DK-2800, Kgs. Lyngby, Denmark
E-mail: {otel,cdje}@dtu.dk

***Abstract*-Governments are strengthening their identity (ID) management strategies to deliver new and improved online services to their citizens. Such online services typically include applications for different types of permissions, requests for different types of official documents and management of different types of entitlements. The ID management scheme must therefore be able to correctly authenticate citizens and link online presence to real world identities.**

Many countries, in particular in the developing world, are currently introducing national ID management schemes for the first time. While most of these countries have paper based records, many of these are regionally based and few of these have been consolidated, so these records may contain incorrect, incomplete, inconsistent or redundant information.

In this paper, we explore the design space for national ID management and online authentication schemes, in this context. In particular, we propose a simple model for issuing national ID numbers that satisfy these goals and use this model to examine two different ID management schemes implemented in Libya, which allows us to compare different approaches to national identity management. The two schemes were implemented within a fairly short time, so we may assume that the cultural, social, educational and technological factors remain unchanged. This allows a direct comparison of objectives and means. Based on this examination, we evaluate the current Libyan ID number system with respect to the identified objectives. Our evaluation of the two Libyan NID schemes show that if National Identity Management does not fully meet the requirements identified in our simple model, then it may be vulnerable to various forms of online risks such as impersonation and identity theft attacks. Considering online crime, during the design of an Identity Management system, is especially important in developing countries, where such crimes have not previously existed in the society.

Keywords: **Identifiers, Authentication & Identity Management**

I. INTRODUCTION

Nationality is defined as "persons having a common language and culture form a nation and, as such, ought to be entitled to self-government as a state'' [1]. Identity means "the condition of being a specified person in which one's attitudes and actions can define" [2]. Therefore, national Identity means identifying a specific person in a society which has a common language and culture. Various countries' governments around the world have been working on providing a unique identity to their citizens. Many of them have already implemented national identity schemes, e.g. the Scandinavian countries Sweden, Denmark and Norway introduced Personal Identity Number (PIN) schemes before computerization in 1947, 1968 and 1970 respectively [3]. There are, however, other countries, which have only introduced such schemes in the last decades. One example is India, which in 2009 decided to introduce a Unique Identification (UID) for all its citizens and hence launched the UID program called "Aadhaar" [4]. Another example is the Libyan national number initiative which was implemented in 2013, but neither of these schemes is fully implemented yet. This means that citizens in those countries have no standard means to prove who they are. This becomes problematic in the transformation to e-Government, where government services are provided to citizens online. The national ID is increasingly becoming the cornerstone of a secure and trusted ecosystem. In fact, many countries have extended their traditional National ID Number (NIDN) schemes by introducing national ID card schemes to support new functions such as identification, authentication and digital signatures that integrate with existing technologies. Thus, digital identity is now the primary means by which a natural person can access government e-services [5].

The main drivers behind implementing national Identity Management (IDM) are to improve the identification and authentication mechanisms in order to reduce crime, combat terrorism, eliminate identity theft, control immigration, stop benefit fraud, and provide better service to both citizens and legal immigrants [1][2][6]. Therefore, the introduction of a single national identifier is generally considered an essential step towards the introduction of a technology to integrate data about the individual citizens quicker and far more easily.

There are various characteristic of good identifiers including universality of coverage, each person should have an identifier, uniqueness each person should have one identifier and no two persons have the same identifier, and , permanence through the lifetime of the individual [1][7]. In order for an identifier to be operational, it is also required that each person can be linked to their identifier in a verifiable way. While this is not a characteristic of the identifier per se, we include "verifiability" as a separate goal in our list of requirements. Digitalization and electronic records are fairly new in the context of government records, so we also need to consider how PINs are assigned and used in e-Government. The typical PIN lifecycle consists of three phases: creation, use and retirement. A PIN is normally created and assigned at birth or when a person immigrates and/or becomes naturalized in a

country, but people born before the start of electronic record keeping, may have to apply for a PIN later in life. A PIN may be used to link all official records regarding a single person; so many different authorities will have access to the PIN. This means that it is extremely important not to use the PIN as a knowledge based authentication factor, as it is done in some countries, because knowledge of a person's PIN will be distributed among all government agencies that the person has interacted with, i.e. *the more useful a PIN is as an identifier the less useful it is as an authenticator*, Finally, a PIN will be retired, but not necessarily deleted, when a person dies or loses his citizenship, e.g. as a result of emigration and/or naturalization in a different country. The quality of a digital identity created as a result of an application from an existing person depends on the accuracy of data information in the originally filed paper records that are to be transferred to electronic form.

One of the main issues of digital identity is the possibility of fraud, i.e. that one or more of the four requirements listed above are not met. Unique number projects, however, introduce a number of complex risks, such as duplication, impersonation and ID crimes [2][5][8]. Although the benefits of most national ID schemes are fairly similar, the culture, social norms, citizens' skills and historical context in term of digital infrastructure, may be quite different, so those factors impact on the design of national ID systems. We therefore need to understand how these factors influence the design space for IDM for e/Government services. In the past decades, the Libyan government has undertaken two separate efforts to develop a national ID with similar infrastructure and culture. This allows us to examine different design choices in a context, where culture and the legacy infrastructure remain largely unchanged. This paper is going to introduce a simple model of issuing a national ID number, which considers the features of good identifiers in terms of uniqueness, universality, permanence and verifiability and then evaluate the first and second Libyan national ID by analyzing both systems to identify strengths and weaknesses of both systems. Part of this paper is based on an interview with 5 members of the Libyan national ID team project to get information about why the first national ID project was cancelled and what are the new features of the new project.

The structure of the rest of this paper is as follows. Related work is presented in the next section, and the new model is introduced in the following section. The forth section presents the Libyan national number systems. Finally, analysis and discussions are presented in the last section.

II. RELATED WORK

Many developing countries do not have national identity systems in place, and many of the ones that do, suffer from high rates of under-registration [4]. The implications of this are societal exclusion that limits access to education, health, banking, and opportunities for personal economic growth. Zelanyr evaluates the Indian Universal Identity (UID) project and identifies the main driver as linking people to various applications including passport, driver's license, tax, bank accounts and elections, i.e. the Indian UID is primarily used as an infrastructure for identification and verification. All the records from the old system were converted into electronic records. Once the new system was operational, it took a period of two months for the new system to de-duplicate the 86M demographic database as well as the 56M iris database that had been established until that time [4]. This study indicates that one of the main issues in developing countries is that citizen's information in paper based registers may be incomplete, duplicated or inconsistent, which results in a poor digital infrastructure.

The online environment allows for the collection and interconnection of larger amounts of information than ever before. This may have tremendous benefits to both governments and citizens, but it also creates several risks that did not exist in the more traditional paper-based systems. For instance, one Norwegian study reported that, in 2004, members of Norwegian Public Service Pension Fund (NPSPF) could apply online for loans by simply entering their social security number (SSN). If the SSN was valid and belonged to an NPSPF's member, then the sender received a message containing the person's name, address and zip code. The author of the Norwegian study showed that it was possible to determine valid SSN using NPSPF's loan web page by implementing a script to build a database containing the previously mentioned information and furthermore, it is possible to classify SSN to a set of people based on specific area using zip code[9]. Another study summarizes the implication of loss or compromise of digital identity in terms of financial loss, emotional distress and reputational damage. The author refers the implication of digital identity to the presumption that the digital identity recorded and used under the scheme is authentic, accurate and exclusive [5]. In practice, issues exist where systems do not correctly recognize the identity of a citizen or where it permits the identity to be misused by another person. Countries that recently adopted such projects should benefit from other countries' experience and take this into account to avoid such mistakes when implementing a digital identity scheme.

One study [9]reported that Government identity management can be implemented in different ways so it is useful to assess these differences against historical, cultural and social backgrounds and these elements can often be as important as technology in determining an approach to identity management. Accordingly, the public and private sector are now producing a wide range of reference frameworks aimed at achieving consistency in designing privacy and security into identity management systems and as result, they are gaining greater community acceptance. Authors took New Zealand's identity management as an example case. New Zealand's identity management system is based on a Government Login system to provide both single and multifactor authentication to support services with different transaction values and associate risks, while identification is performed via the Identity Verification Service (IVS). Authors concluded that New Zealand example demonstrates the value of starting from a sound understanding

of the policy environment and a clear vision of what is to be achieved. Therefore, identifying the function of digital identity and mechanisms to achieve these functions are important as well as legislation that regulates the privacy of individual's information and data protection. All these components and others make the vision clear..

Al-Khouri studied the implementation of the national ID programme in the United Arab Emirates (UAE) and provides some suggestions to increase public acceptance and consequently increase project success chances. The author reported that the implementation of the project must take place in three stages. In the first stage, the project must attempt to enroll the population for the new ID card with a minimal set of data; as only primary identification data will be required for first time enrollment, it was proposed to eliminate the application form and rather make use of the existing electronic data in the Ministry of Interior's database to obtain and verify the citizen's personal information. In stage two, efforts must be directed towards promoting and enforcing the presentation of the new ID card for identity verification and as a pre-requisite to access the most frequently visited government services. The organizations that provide these services then need to maintain the new ID numbers in their databases, which should be used when moving to stage three of the strategy which requires the national ID database to interface and integrate with these databases. In the lessons learned section, Al-Khouri identifies some points that should be considered when implementing IDM, including that proper planning is essential to the success of such projects. The project team should take enough time to focus on the procedure of enrolment of the whole population and the issuance of the new ID card. Such programmes also need to put much effort into promoting e-identity and e-verification services using the new ID card. It would be interesting to measure the impact of national ID programmes on the overall government economy[10] .

The above paragraphs show the absence of national identity schemes in developing countries and shortcomings of such scheme when they exist. Lack of a clear vision to introduce National identity leads to threats to privacy and security of national identity schemes. As a result various online risks might exist, which could cause financial loss, emotional distress and reputational damage. The integrity and accuracy of national ID management schemes that transfer the individual's existing records to electronic form depend on the quality of the existing paper based records. Therefore, it is necessary to validate the individual's paper based records in terms of completeness, correctness, non-duplication and verifiability, before they are transferred to electronic form. The following section will introduce a simple model that identifies national identity requirements and properties of good individual's record, which will be used to evaluate Libya's national number scheme.

III. SIMPLE MODEL FOR ISSUING NATIONAL NUMBER

A. Concepts of Personal Identity Number (PIN):

A personal identity number is a number that acts as a unique identifier, which represents an individual during remote interactions with public and private sector agents. According to Clarke [2], human identity has become central to our modern conception of mankind since the renaissance. The original needs for identification were social rather than economic. Relatives and friends recognize a person on a contextual basis, in which physical appearance, voice characteristics, knowledge of private information all play a part. As the complexity of economic transactions increased, the need arose for parties to know with whom they were dealing. It became normal for parties to provide one another with information about themselves, appropriate to the nature of the transaction[2].

Organizations often assume that there exist a one-to-one relationship between persons and identities, no matter how many different roles he or she may play, or choose to adopt[2]. Multiple identity management is a significant issue for individuals and organizations. Beynon-Davies [7] studied the issue of IDM in terms of a semiotic framework consisting of three interrelated processes: authentication, identification and enrolment. The study examined different forms of personal identifiers and characteristics of good identifiers. Identifiers are grouped into natural identifiers and surrogate identifiers. Natural identifiers are often fail to provide the uniqueness demanded by organizations and their information systems. Surrogate identifiers include additional features such as codes and tokens used to uniquely identify individuals. Our model is based on the characteristic of good identifier identified by the studied mentioned above [2][7]. The difference between the above studies and our study is that the above studies investigate the issues of identifier facing multiple identity management while we focus on national identity scheme issue.

Blume [3] studies the legal system in which the personal identity number (PIN) is used. The PIN in Scandinavian countries is described as a piece of paper with the name of the individual and the unique number. There is no other information on the paper, e.g. a photograph, to help authenticate the person. The study identifies the important elements and principles that should be considered when introducing personal identity number schemes. These elements include purpose, expiration, issuer, data protection, regulation and legislation. Therefore, based on these studies we developed a simple model that will be used to evaluate both of Libya's national ID schemes.

B. Simple Model

To achieve the goals identified in the introduction section, our simple ID management model must satisfy the following requirements.

1) Characteristics of good identifier

- Universality: every citizen should have an identifier.
- Uniqueness: every citizen should have one identifier and no two citizens have the same identifier.

- Permanence: the identifier should not change, nor be changeable without authority.
- Verifiability: there should be reliable means to verify the mapping between citizen and identifier.

2) Properties of individual's records

- Accuracy: Individual's records should have correct information.
- Complete: Individual's record should have all required information, such as name, surname, date of birth and contact information.
  - Consistency: Individual's records within various government bodies should have the same information.
  - Singularity: Every individual should have one record to avoid duplication.

3) Requirements for National ID Management

- Build a digital national database.
  - Capture all individual's information to ensure universality.
  - Ensure that only correct information is recorded and keep in registers. This requirement to ensure accuracy.
  - False information should be amended to increase accuracy.
  - Missing required information must be completed, e.g. mobile number, email and postal address, to ensure completeness of the required information.
  - Consistency of individual's information within various government bodies should be verified to avoid inconsistency of the individual's records.
  - Remove individual's duplicate records to ensure uniqueness of records.
- Legislations and regulations
  - Issue rules to distinguish private information from public information.
  - .Issues rules concerning illegal use of national identity.
  - Issues rule to regulate distribution of information between government bodies and organizations.
  - Issue rules that concerns illegal use of national identity.
- Enrollment requirement
  - An applicant needs to prove her/his entitlement to a NID.
  - An applicant needs to submit an application requesting NID.
  - An Authority needs to validate applicant's entitlement.
  - An Authority needs to ensure that the applicant has not been issued a NID before.

4) Model description

We assume that a national database as well as legislation already exists. Therefore, we focus on the process of issuing a NID in the following. First, an applicant fills in a form with his or her basic personal information including name, surname, date of birth, contact information and official documents proving his personal information. The National Identity Authority verifies whether the applicant qualifies for a NID number or not. An applicant qualifies for a NID number if he has an official document that has already been registered in a civil registration authority or any other national registration that contains (part of) a population register. The other requirement is that the applicant should not have been issued a NID number before - this can be checked from NID database. If an applicant does not qualify, then his request will be rejected, otherwise, he will be asked to submit additional information to check that he has not been issued a NID with different official documents, i.e. exploiting inconsistencies in the paper based records. This additional information could be biometric data, such as finger print, photograph or DNA. The NID authority then compares the biometric data submitted by the applicant with the biometric data previously stored in the NID database and rejects the application if a match is found. Finally, the NID authority provides qualified applicants with a national id-number and credentials that can subsequently be used to verify the applicant during online authentication. Figure 1 shows the process of issuing a national number that will be unique and reliable. Figure1 shows the individual steps when a user applies for a national ID number from the NID Authority: 1) a citizen shows up in person to submit the application form and required documents, 2) applicant's information is sent to the verification process, 3) verify authenticity of submitted documents from the civil records

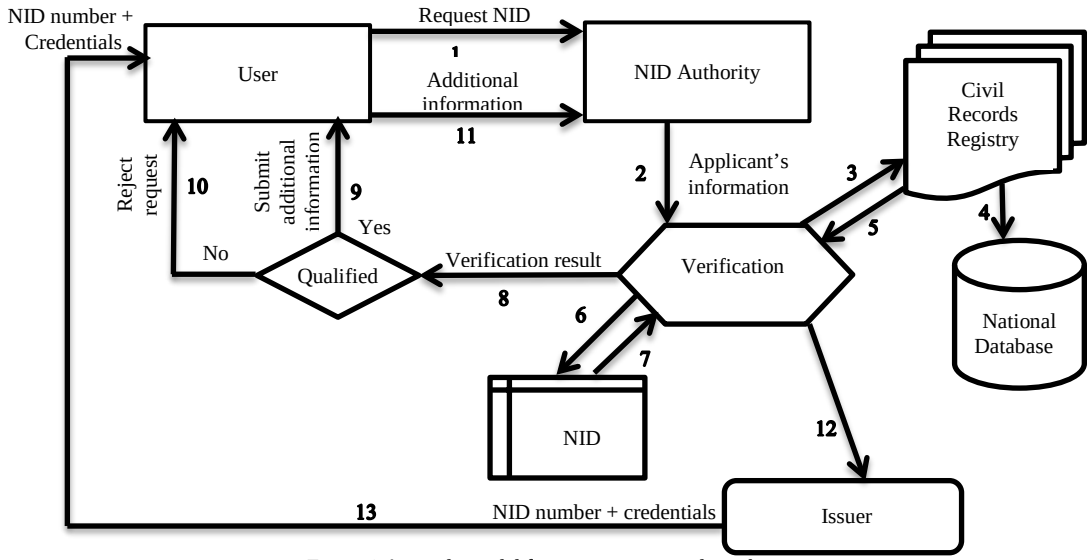

Figure 1 A simple model for issuing a national number

registry, 4) civil records registry checks records against the national database, 5) civil records registry responds to the NID authority, 6) if the documents are genuine, the verification authority check NID's database o see if it has issued a NID number to the person before based on biometric information, 7) return result of check to NID Authority, 8) verification result will determine if user qualified to get NID number or no, 9) if yes, more information will be requested, 10) if no, citizen's request will be rejected, 11) a citizen will submit additional information, 12) NID will issues NID number + credentials, 13) credential will send to citizen.

IV. LIBYAN NATIONAL ID SCHEMES

As mentioned earlier, the Libyan government has implemented two different IDM schemes; the first scheme was based on an ID smartcard which contains biographical and biometric information about the citizen. The second scheme is just a number that links a citizen with his recorded information. The duration between the discontinuation of the first project and the initiation of the second project was about a year, so technological and non-technological factors can be assumed to remain constant. The question is whether implementing two different IDM approaches with the same digital infrastructure, culture, citizen skills will eliminate the risks of online transaction. This section gives an overview of existing Libyan official documents and a summary of an interview we made with Libyan officials, before we describe the first and second Libyan national ID projects.

A. Libyan official documents

A family book, shown in Figure 2, is an official document, which is issued by the civil registry authority to each Libyan family. It contains information about all members of the family (husband, wife and children) including name, surname, date and place of birth for each member of the family. Each family book contains a unique six digits number used to differentiate each family book; this number is called the auditing number.

Identity plastic card is another compulsory official document issued to all Libyan citizens older than 18. The Immigration Office is the responsible government body that issues identity plastic cards. The card contains citizen's information including name, middle name, surname, date of birth, photograph, hand written signature and a fingerprint. The card is used to prove the identity of the holder when travelling from one city to another. It is also used as an identity proof for all government transactions. Traveling outside the country needs another document which is a passport. Libyan passport contains all the previous information. All the information included in both ID card and passport is hand written.

Figure 2 Libyan Family book

B. Summary of interview with NID number project team

The aim of the interview is to collect some information about the process of issuing new Libyan national number. A general discussion was done with some members of the project team about the aim of the project and how it is implemented. We asked various questions to understand the main objectives of the new Libyan NID, possible weaknesses of the previous NID scheme and the motivation for developing a new scheme. Also, our question focused on the mechanisms and process they made to achieve their goals. For example, we asked how they verified the correctness and completeness of an individual's records. Similar questions were on how they verified the uniqueness of the issued NID numbers. Their answer regarding uniqueness was that they assumed every Libyan family only has one family book. We summarized the result of the interview as follows:

- The goals of the second scheme appear quite similar to the objectives of first Libyan national ID project.
- There were no reasons mentioned in terms of technical weaknesses, such as security issues, usability issues or any other technical weaknesses.
- They assumed that every family has one family book.
- They have not verified social benefit fraud by people who may have more than one family book.
- They have not validated that family members who married or died have been removed from the family book.
- They have not validated correctness, uniqueness, consistency and completeness of individual's record at civil registry.
- There are few errors during input data and most of those errors were date of birth.
- Citizens can correct input error data by contacting their civil registry.

C. First Libyan National Id-number Project

This sub section will summarize the first Libyan national ID scheme in terms of motivation and drivers, requirements to issue national ID.

1. Motivation and drivers

- Eliminate social benefit fraud.
- Improve quality of public services for citizens.
- Build a digital infrastructure for Libyan e-government services.
- Build a national database to store a citizen's information.

Items	First Libyan NID number	Second Libyan NID number
Aim	To prevent duplication, illegal immigration, improve digital infrastructure, reduce id theft	Prevent duplicate salary, start point of Libyan e-G, improve performance and efficiency of public sectors.
Registration procedure	Applicants come in person	Based on the civil register records
Requirements	Libyan family book and fill a form	has a record in civil register and has a family book
Getting NID number	Issues smart card contains NID number	Check by SMS message or through NID web site
Number of digits	13 digits	13digits
Biometric data	Finger print and DNA	In future
Uses	Cancelled before use	Registration of election

Table1 summary of the information about two Libyan NID number schemes

2. Requirements to issue first Libyan national ID

To get an ID-card in the first Libyan ID scheme, an applicant has to meet the following requirements:

- An applicant has to fill in a specific form for the national id.
- An applicant needs to provide an official government document which contains all the names of the applicant, i.e. first name, middle name, third name and surname.
- An applicant needs to submit the applicant's biometric information including the fingerprints of all ten fingers, scanning the applicant's signature, a photograph of the applicant's face and the DNA of the applicant through a saliva swab.
- The applicant verifies the correctness of the information on the printed paper and pays about 3US$ as a fee for the ID-card.

D. Second Libyan National ID Scheme

In 2012, the Central Bank of Libya expressed concerns about identity fraud. At the time, there was no definitive official database of Libyans and according to the prime minster, "300,000 Libyans were in receipt of more than one state salary and some had more than 60 salaries" [11].

1. Motivation and drivers

- Central Bank of Libya has concerns about identity fraud.
- Increasing number of citizens receive more than one state salary.
- Provide equality of opportunity access to information and prevent duplication and corruption.
- Improve e-services.

2. Requirements

The only requirement to get the new Libyan NID number is the family book. Therefore, all Libyan citizens who have a family book have been issued a NID number by the government. There are two methods to get your new national number including SMS messages and the national identity number web site. In the first method, an SMS message, containing a family book registration number and the date of birth, is sent to the NID system, which replies with a message containing the NID number. In the second method, a family book registration number, the date of birth and a random number generated by the system is entered through the NID web site, which then displays NID number. After a citizen gets a NID number all the family members included in the family book will be issued NID numbers and all new born babies will be issued a NID number during the registration of birth.

V. Analysis:

Before we start to analyze the two Libyan NID number schemes, we are going to summarize some points in the table above:

1. Duplication of Libyan new NID

The new Libyan NID is based on the existing civil registry records. The civil registry was working manually and not centralized, so it is difficult for the civil registry's officers to discover if some families have more than one family book. The manual registration of information in the civil registry generally means that it is open to human error and there are cases where some family members are not removed from the family book when they marry or die. These issues negatively reflect on the new NID and we realized them by contacting some citizens who have two NID. When we asked the NID project team members, during our interview, about such cases, they acknowledged that there are a few such cases, but that it is not a system error, but rather a civil registry database error. Simply dismissing such errors as civil registry database errors, however, fail to acknowledge the team project plan error that such problems have not been taken into account, e.g. by sanitizing and normalizing the civil registry database, before the data was imported into the new NID database. Furthermore, the enrollment procedure contains an error because the project team has not required citizens to apply for new NID, rather they produced the NID automatically to all citizens who have a family book. In our model (fig 1, a citizen needs to explicitly apply for a NID by filing a special form and submitting additional biometric information, e.g. a fingerprint, so the system can verify the submitted information against government records to check the correctness of the

document and subsequently check the NID database to prevent duplicated information. One study reported that in many countries, the national identity systems are based on a civil registry, but it is quite difficult to come up with a high integrity civil registry [4]. However, this problem is exacerbated in third world countries, such as Libya, where corruption in public administration is possible and where records are maintained manually. When such countries decide to introduce technology they must identify main challenges of their country in term of culture, regulations, policies and infrastructure. A few third world countries have planned well for the introduction of IDM technology, such as the United Arab Emirates (UAE). In 2003, when UAE government decided to develop a modern identity management system to improve the performance of public administration, they clearly identified all processes for the enrolment, processing, production and delivery of ID cards. The UAE national ID system has avoided duplication of individual's identity by implementing biometrics based on fingerprints [12]. The Indian Universal Identity program (UID) eliminates duplication of identity by implementing a multi-modal system[1] of biometric data to ensure the highest accuracy levels and the smallest room for error [4].

2. Authencity of new NID

The structure of the Libyan NID consists of thirteen digits, the first digit represent the sex (one for men and two for women), the next four digits represent year of birth and the last seven digits should make the id-number unique to differentiate them from others. In the above sections we mentioned how citizens obtain their NID by sending an SMS message which contains the family book registration number and date of birth or through NID website by entering the same information and a random number given by NID system. It is clear that NID system cannot verify citizens based on those information for example, a citizen can send any six digits as a family book registration number and date of birth randomly by SMS or through the NID website, then the NID system will send back NID number if this information corresponds to a record in the database without checking if this information belongs to that particular citizen or not. This issue is quite similar to the issues of SSN at Norwegian Public Service Pension Fund that mentioned in related work section. Another limitation is that the NID website has no limit on the number of attempts to get a NID number, so it is possible to make a brute force attempt at guessing one piece of information if the other piece is known. It is generally considered good practice to have a limited number of attempts for entering authentication information, such as online banks, which often give users only three times of retrying to enhance security of the system and prevent an exhaustive search to get all national number/family book numbers. Furthermore, the social society, Libyan culture, and the rate of illiteracy, means that friends and family members often carry out administrative duties for others. Moreover, social engineering or corruption in some public administration makes it easy to get family book registration number and date of birth for friends, cousins and neighbors. As a result, the citizen's personal information, as well as family member's information, are not protected those information include name, surname, date and place of birth and national ID number. Often, the identity number is not considered as secrecy but it should be considered as private information. For example, Danish data protection provides legislation that protect identity number against misuse [3]. The random number, provided by the system, cannot prevent citizens from retrying to get other's NID, but is only resist automated impersonation attacks from malicious software from impersonation. One of the main reasons that Libyan NID system could not verify citizens because NID team project has not provided any credentials that can be used to link individual with his personal information. Implementing one of authentication methods including something you know (such as passwords), something you have (such as smart cards), and something you are (such as fingerprints, iris) is important in such projects.

3. Application

In 2014, the Committee for the UN high Commissioner for election to the committee of the founding of the Constitution announced that citizens can register for election by sending SMS containing NID and constituency number to the registration center. First, as some citizens have two NID that means that they can vote twice. The second issue is that citizens can send NID of another citizen along with the number of a remote constituency, and thereby prevent them from voting because the NID system has not provided sufficient verification processes as well as election registration system. As a result, a number of citizens, when they tried to register by sending SMS message, received a message that they had already registered and that they should use the previous mobile number to update information, such as changing constituency number. However, this is impossible without knowing who registered them or which mobile number sent their information. When such cases increased, the Committee suggested that any citizen who could not register through sending SMS needed to come to the registration center with proof of identity and then they will cancel the previous registration and give a new registration number for the vote, so they solved the issue manually.

Based on our interview with project team members of the new Libyan national number, and information we collected from different sources regarding first Libyan national number, we realized that, the objectives of the new Libyan national ID and the previous Libyan national ID are quite similar, but the implementation were very different, e.g. the registration process and the method of getting a national ID as illustrated in Table 1. Based on our model, the weakness of new Libyan NID was identified as relying totally on the civil registry without sanitizing or normalizing information records. The registration process in our model requires a citizen to come in person for enrollment and to submit biometric data. This requirement will prevent duplication of data and partially

[1] In this context, Multi Modal Biometric including finger prints, iris and facial recognition to ensure high accuracy.

based on civil registry to check the validity of documents. The second requirement was to provide a credential that will be verified by the system to ensure the authenticity of a citizen. This requirement is also missing from the new Libyan NID number, and we have seen the negative effect of that during e-voting registration example. Therefore, there is no clear technical reasons make Libyan government to change national ID especial the process of registration and verification of the previous project looks much more secure than the new project. Furthermore, personal information of citizen is not protected. In new Libyan NID system

VI. Conclusion

The introduction of a national ID is considered an initial step to the introduction of a technology to enable private and public sector organizations to integrate data about the individuals far more easily. Identity systems have a wide range of uses, such as reducing incidents of identity theft, combating terrorism and providing better services to citizens and residents. On the other hand, implementing such projects has a number of risks that did not exist in more traditional paper-based systems. This paper introduced a simple model for issuing a national id-number that satisfies characteristics of good identifiers, such as uniqueness and verifiability. To study whether the implementation of different IDM schemes with the same digital infrastructure, culture and social background will reduce risks of online transaction, we evaluated two implementations of national ID numbers in Libya. We found some weaknesses including vulnerability of personal information, duplication of NID, i.e. that a person could have more than one NID. For example, we have seen how the election registration in Libya is affected by national ID issues and at the end they were forced to resolve problems through manual processes. .It is clear from the study that new Libyan NID system has the following limitation:

- Failed to link online presence to real world identity and as result exposed to various forms of fraud. For example with few tries through NID website, it is possible to get other's NID.
- New Libyan NID database based on non-normalized records of civil register. It means issues as incomplete, inconsistency and duplication of individual's record will be inherited in the new digital database. For example, some citizens have more than one NID.
- Privacy of NID has not been considered and as a result it is easy to get other citizen's NID.
- Incompleteness of contact information at individual's record such as mobile phone, home address and emails makes it difficult to contact citizens.

Developing countries that adopt such projects need to plan them well, such as defining criteria for choosing a project team member, identifying the main objectives and the requirements of the project, and considering the digital infrastructure, social culture, and availability of experts. All those factors, and others, need to be considered closely, to benefit from advanced technology. Finally, the project team of the new Libyan national ID needs to make a review and makes some updates to the processes, such as enabling verification, to make the Libyan NID number a digital infrastructure that meets the planned requirements and avoids negative effects of NID numbers.

VII. References

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