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Education Management Information System

in Developing Countries

transferring experience of digitalization to The Gambia

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NTNU
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Master of Science in Informatics
Submission date: June 2019
Supervisor: Eric Monteiro

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Preface

The work of writing this thesis was carried out during the academic year of 18/19 as a final part of our master's degree in Computer Science at NTNU. It reviews previous research to examine the implementation of EMIS in the context of developing countries. The subject was selected out of natural curiosity and genuine interest in global challenges. With our desire to contribute and influence a meaningful context, hopefully, our work could make an impact and inspire others to seek out a similar path in the future.

Our effort and collaboration in writing the thesis have required good communication and structured teamwork. We have learned the value of working effectively and expedient with others, and solemnly believe that people are better equipped when solving problems together. We have made good use of the online, real-time collaborative writing tool Overleaf, that support data storage and version control. It has been a time-consuming and educational process where we have obtained a more profound understanding of the nature of information systems. To entail a thorough review of the infinite amount of existing research and literature, proved to be a massive effort. In the end, have our conducted research and fieldwork provided us with a solid foundation in finding and describing requirements, and to analyze and document results. The process has been a long and winding road. Still, the task ended just as quickly as it started. The payoff and consolidate remainder is the sense of mastery to deliver a thesis we are proud of.

Above all, we want to thank our supervisor Eric Monteiro for invaluable help and guidance. We have been fortunate to benefit from your expertise. We would also like to thank the HISP UiO and HISP West and Central Africa for their cooperation and giving us the opportunity to travel. Their facilitation and considerations made the journey as uncomplicated and pleasant as possible. Finally, we would like to thank everyone in The Gambia who welcomed us, organized our stay, and contributed to an eventful and memorable experience.

Trondheim, June 21, 2019

Synne Byre and Ingvild Gravem

Abstract

It is becoming increasingly important to identify effective and targeted focus areas for development, to address the digital divide and ultimately decrease the gap between developed and developing countries. This thesis aims to further build on the knowledge that comprises a significant part of the nature of information systems. By focusing on the implementation of a digital system, it explores the prospect of using District Health Information System 2 in the domain of education to meet development demands. DHIS2's long-established existence and experience from the health sector have significant potential and transfer-value. However, the importance of a satisfactory system emphasizes the importance of recognizing and addressing future challenges in order to avoid deficient implementation.

The study's philosophical foundation and research approach consist of an interpretive case study at an early stage in the implementation of a digitalized Education Management Information System in The Gambia. A four-week fieldwork constitutes the empirical data collection, in close collaboration with the Ministry of Basic and Secondary Education, and an implementation team from HISP West & Central Africa. The thesis has further explored how a distributed workload affects both the completion of the system and the data collection. Schools were visited, and interviews of teachers were conducted to focus on daily workloads, workflows, and attitudes towards a digitalized system.

The study shows a widespread optimism and great anticipation towards a new system and its success. Despite the significant amount of failures throughout the history of IT projects, acknowledges the thesis how transfer-value between the domains may ensure successful implementations. It will nevertheless require a thorough understanding of the application of technology, users, and the domain. The implementation of EMIS is still at an early stage, which indicates little grounding for predicting neither the project's success nor failure. Nevertheless, environmental and infrastructural factors in The Gambia may postpone a national implementation. However, there are several lessons to be learned for future projects to extract beyond the nuances of the contexts in terms of both success factors and pitfalls concerning all the building blocks encircling information systems.

Sammendrag

Det blir stadig viktigere å identifisere effektive og målrettede fokusområder for å adressere det digitale gapet og redusere skillet mot utviklingsland. Avhandlingen har som mål å bygge på kompetansen som omfatter en betydelig del av informasjonssystemer. Ved å fokusere på implementeringen av et digitalt system, undersøker vi mulighetene for å ta i bruk District Health Information System 2 i utdanningsdomenet for å møte utviklingskrav. DHIS2 sin lange fartstid og erfaring fra helsesektoren har en betydelig overføringsverdi. Men for å sikre bærekraftig digitalisering, må hensyn til potensielle lokale utfordringer tas. Betydningen rundt en tilfredsstillende systemer, understreker viktigheten av å anerkjenne og angripe fremtidige utfordringer, for å unngå mangelfull implementering.

Forskningen består av en casestudie på et tidlig stadium i implementeringen av et digitalisert Education Management Information System i Gambia. Et fire-ukers feltarbeid utgjør datainnsamlingen, som skjedde i nært samarbeid med utdanningsministeriet i Gambia, samt et implementeringsteam fra HISP West & Central Africa. Avhandlingen har videre undersøkt hvordan en distribuert arbeidsbelastning vil påvirke både utførelsen av systemet og datainnsamlingen. Det ble besøkt skoler, og avholdt intervjuer med lærere med fokus på deres arbeidshverdag og holdninger til et digitalisert system.

Studien viser at det er en utbredt optimisme for å digitalisere, med store forventninger for suksess. Til tross for at en betydelig mengde av IT prosjekter gjennom historien mislykkes, anerkjennes det at overføringsverdien mellom domenene kan bistå til en vellykket implementering. Det vil likevel kreve en grundig forståelse rundt anvendelsen av teknologi, folk og domenet. Implementeringen er fortsatt i en tidlig fase, som tilsier lite grunnlag i å kunne forutsi verken prosjektets suksess eller fiasko. Likevel kan faktorer rundt miljø og infrastruktur i Gambia utsette en nasjonal implementering. Det er imidlertid flere lærdommer å hente for fremtidige prosjekter, som trekker seg utover kontekstenes nyanser med tanke på både suksessfaktorer og fallgruver i relasjon til alle byggeklossene som omfatter digitale system.

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Acronyms

ASC Annual School Census

AYB Annual Year Book

BSD Berkeley Source Distribution

DHIS2 District Health Information Software 2

ECD Early Childhood Development

EMIS Education Management Information System

FOSS Free and Open Source Software

FSF Free Software Foundation

GDP Gross Domestic Product

GNU Gnu is not UNIX

GPL General Public License

HISP Health Information System Programme

HMIS Health Management Information System

ICT information and communication technology

IS information systems

LBS Lower Basic Education

MDG Millennium Development Goals

MIS Management Information System

MoBSE Ministry of Basic and Secondary Education

MoHERST Ministry of Higher Education Research Science and Technology

NORAD Norwegian Agency for International Development

NTNU Norwegian University of Science and Technology

OS operative system

OSI Open Source Initiative

OSS Open Source Software

PTA Parent Teacher Association

SDG Sustainable Development Goals

SLA Service Level Agreement

TPMR Teacher Performance Monitoring Record

UBS Upper Basic Education

UiO University of Oslo

Chapter 1

Introduction

With today's technological advances and resolution to digitalize, the presence of digital systems is becoming increasingly prominent in all aspects of everyday life. According to Gartner (2019) are global IT spending in 2019 projected at $3,8 trillion, a number that is estimated to grow in the years to come. There is no doubt that information and communication technology (ICT) affects peoples lives drastically, and for organizations, information systems (IS) can be significant at all levels from organizational governance to operational and executive levels. ICT is, therefore, considered a prominent partner to contribute to utilized outcome and value. However, highlighted by the failures in the history of ICT projects (Heeks, 2002b, 2003), large and complex projects are difficult to handle in a timely and satisfactory manner. Implementing a new system can also be challenging if the intended result is too ambitious.

Nevertheless, IS are only a part of the bigger picture in any domain, business, organization, and routines. All domains have their own unique goals and requirements that ICT need to adapt to, and how to make the best use of technology is unmistakably essential to achieve those goals. Also, when developing an information system, there are countless approaches and combinations when suiting and customizing the building blocks of a system. People, processes, and data are all critical aspects of a holistic and complex system to support IS within a specified environment. Increasing globalization demands also require universal solutions, that could be unlikely to be successful in multiple locations and contexts (Rolland and Monteiro, 2002). In other words, there is no obvious recipe for success. When the perception of success significantly varies based on the views and expectations of different stakeholders, it can be further difficult to

know how and what issues to address. For users, it can be the pleasure of using a digital system, while factors such as resources, time, and labor can be critical success constraints for managers. Furthermore, for organizations or businesses, success factors can be determined on how well a system contributes to profit, management, and decision making.

There is no doubt that a successful implementation requires a thorough understanding of the application of technology, as well as success factors and pitfalls concerning all of the building blocks encircling IS. This thesis strives to further build on the knowledge that embraces a significant part of IS projects, by focusing on the implementation of a new system in the education domain in The Gambia. There are several lessons for future projects to extract beyond the contexts nuances.

1.1 Background

Developing countries have long been dependent on making the most out of their commodities, and countries with inadequate resource supply tend to experience difficulties in developing their country further and gradually become independent. Consequently, developing countries have, for many years, been dependent on aid and assistance from the Western industrialized countries. However, even after prolonged help and support, a country's situation may not improve according to the resources devoted. At the same time, Western countries are continually developing themselves, increasing the disparities between developed and developing nations even more (Reinert, 2007). Thus it has become vital to help identify and manage the critical factors determining a country's development. Doing so can contribute to advance developing countries, which could ultimately lead to them gaining more independence.

One of the critical factors identified by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), is the possibility and quality of education. Hence, one of their objectives is to pursue education and lifelong learning for everyone and to increase young people's learning achievement (UIS, 2018). Their 4th Sustainable Development Goals (SDG) is to provide universal primary and secondary education by the year 2030. However, over the past two years, progress in school attendance has been weak. After a steady increase in children in school since the beginning of 2000, the trend is now flattening out, making the SDG4 virtually

inaccessible. A report from February 2018 showed that almost one in five is out of school, representing 263 million children in primary, lower secondary and upper secondary school. As the quotation below emphasize, making use of technology is vital. However, challenges in how to bridge the digital divide between people with and without access to ICT arises.

> *"There is an urgent need for greater investment in education at the global, regional and national levels, including more resources for data collection and analysis (UIS, 2018, p. 13)."*

1.1.1 Research context

This thesis is written as a final part of a 2-year program in Master of Computer Science (MSc) at the Norwegian University of Science and Technology (NTNU). The work is linked to the free and open source software District Health Information Software 2 (DHIS2)[1], developed through the global network and initiative of the Health Information System Programme (HISP). The Information systems Research Group coordinates the initiative at the Department of Informatics at the University of Oslo (UiO) in Norway, and thus the thesis has been in collaboration with the UiO team. HISP has aimed to increase the efficiency and quality of services in the public domain of low-income countries, and the DHIS2 was initially conceived for the health sector. As part of a pilot project, the use of DHIS2 is now expanding into the domain of education. Still, the research of its implementation within other domains than health is limited, which could challenge realistic expectations of its completion. This thesis aims to study the digitalization of an Education Management Information System (EMIS) in The Gambia, where an empirical study was conducted over a 4-week period in March 2019.

1.2 Motivation

This thesis will, in its best effort, try to understand the possibilities and challenges in order to support developing countries with an EMIS. The research topic was chosen out of interest as it combined both a genuine engagement in information systems, including a desire to do something useful within the field. The liberation to outline the project scope and the prospect of

[1] (www.dhis2.org/)

researching in a challenging context was also contributing factors. Initially, the case selected was regarding Health Management Information System (HMIS) in developing countries. The case would include empirical fieldwork of identifying requirements, and subsequently to implement and test them. In October, this shifted to EMIS within the same context. Thus, the motive changed towards exploring the application of DHIS2 in a sector outside of its typical and traditional domain. The importance of education cannot be stressed enough, as it is the foundation to help a country flourish on a personal, social, and economic level. A successful system may consequently help facilitate policy dialogues and better education system planning. It was compelling to research its implementation within other domains than health, but the occurrence of HISP in the Gambia does not start from scratch. It will complement and exchange experiences from primarily the health domain, making an appealing approach concerning the transfer value from one domain to another. Also, as the previous research is limited, this could challenge realistic expectations of its completion. Hopefully, the effort can ultimately enhance the reporting and utilization of these countries resources.

1.2.1 Research questions and objectives

Our research aims to contribute to theory, methodology, and practice to further develop an understanding regarding the nature of IS. This is applied by understanding the holistic process of successfully implementing an EMIS in The Gambia with the use of DHIS2. As this indicates our direction of inquiry, we present our following research questions:

RQ: *How transferable is DHIS2 to the education domain, and what challenges digitalization in The Gambia?*

To further help to answer our research question, the following sub-questions assist in specifying and narrowing down our research objectives:

SQ1: *How is digitalization affected by the process and the environment?*

SQ2: *What challenges the collection of requirements?*

SQ3: *What challenges a successful system implementation in regards to information quality?*

1.3 Structure of the Thesis

Chapter 2: Literature review focuses on the state-of-the-art the thesis builds upon.

Chapter 3: Research background and context describes our research background and context within the Gambian context, and it's education structure and our field trip context.

Chapter 4: HISP and DHIS2 provide background information regarding HISP and DHIS2.

Chapter 5: Current EMIS in The Gambia will present the current state of EMIS in The Gambia.

Chapter 6: Methodology describes the methodology and frameworks that have been chosen to collect and analyze data. It also presents the background, our role as researchers, and its implication for the thesis.

Chapter 7: Empirical findings will enlighten our empirical findings from our field trip.

Chapter 8: Discussion provides a discussion of our empirical findings, and aims to link this back to our conducted literature review.

Chapter 9: Conclusion summarizes the thesis with some conclusive remarks.

Chapter 2

Literature review

2.1 Software as a platform

Software development involves many steps determining its outcome. These include choices of frameworks and methods to support development processes and work, the collection of requirements and how these are interpreted and understood, architectural design choices, and everything else contributing in the creation of a robust, functional and attractive system. As introduced in Chapter 1, the expenditure on digital systems is continually growing, making it increasingly essential for systems to be successful. However, in response to ever-increasing and altering demands, it is not uncommon that projects do not end up as intended. There may be functions required which were uncalled for in the initial phase determining a software's scope. A vital part of system development has become the capability to respond to emerging needs and desires. It requires flexibility to make significant changes, such as new users or application of use, into account. By establishing a core functionality platform, the software can serve as a basis, to further add and integrate complementary products and modules. These communicate and interact with the platform by using interfaces. Tiwana (2014) express that the survival of any platform is determined by its degree as a vibrant and dynamic ecosystem. Evolutionary, the architecture influences and decides the flexibility of a platform ecosystem by the embedding of new modules and functionality (Tiwana, 2014; Roland et al., 2017). Software architecture varies from being on a scale of fully monolithic to fully modular, thus can highly irreversible choices broadly impact and determine future constraints. It is important to balance all options deli-

cately when embracing new users and application of use. Therefore has processes which adapt requirement engineering become a significant part of development, and is considered an essential measurement to achieve success.

2.1.1 Establishing requirements

Requirements engineering is a term holding many definitions. Despite the various definitions and understandings of the term, it is considered an essential basis for all projects, and a part of all conventional software development models (Balaji and Murugaiyan, 2012). This thesis has adapted its definition from (Dick et al., 2017, p. 8):

> "the subset of systems engineering concerned with discovering, developing, tracing, analyzing, qualifying, communicating, and managing requirements that define the system at successive levels of abstraction."

Requirements help ensure what stakeholders need from a system and what it must do. However, it is vital to remember that stakeholders may have varying foundations to understand requirements. Thus, it is important to ensure universal comprehension for all stakeholders, regardless of roles and backgrounds. In 2014, The Project Management Institute (PMI) discovered that 47% of projects not reaching their goals had inaccurate requirement management as the primary cause (Bieg, 2014). This stress the importance of paying attention to a system's customers and end-users, as it increases the collection of "real requirements," as illustrated in figure 2.1. Customer satisfaction could also, to a degree, determine a project's success.

As cited in McConnell (1996), the Standish Group survey from 1994 found that user involvement determine IS projects success. A user-centered approach intends to involve users throughout development. It is widely acclaimed and endorsed, and it is logical that people who require a product to perform a task, also have a valuable perspective of its implementation (Preece et al., 2015; Mao et al., 2005; Gould and Lewis, 1985). Completing a user-centered design also strengthens the usability of systems. It is recommended to perform empirical measurements as early as possible, as prototypes and simulations enhance rapid feedback. Not only provides it valuable information on how people react to a product by giving them a "look-and-feel" experience, but it also contributes to users perception of a system. Their performance and reactions can then be

observed, recorded, and analyzed throughout a repeated cycle of design, test, measure, and re-design, which ultimately ensure the likelihood of a successful system (Preece et al., 2015; Gould and Lewis, 1985).

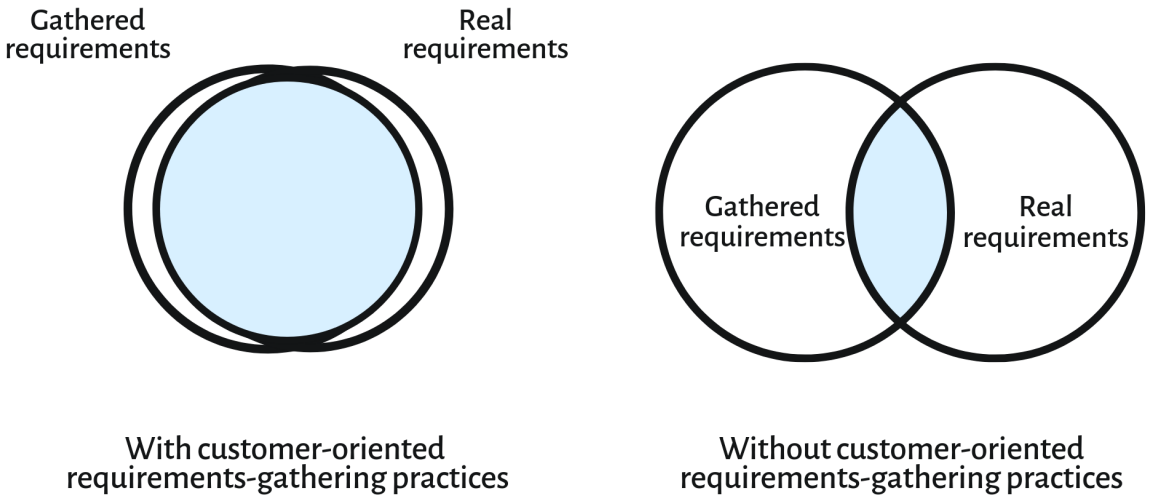


Figure 2.1: Discovery of requirements, adapted from (McConnell, 1996, p. 240)

As explored, requirement engineering provides valuable information on how easily people learn to use a system. However, there are many pitfalls to consider that inhibit the discovery of requirements when including users. A known challenge is that users do not always understand what they want. Developers must consider to what degree the users are technically inclined. They may lack awareness of present technology and the understanding of software development processes. Consequently, they may not have a clear idea of their requirements. Users may have too optimistic and unrealistic expectations, thus it necessary to manage realistic expectations to prevent resistance and rejection of a system. As users may not have considered alternate or improved ways of performing their tasks, they might change their minds as they have been unaware of the options. The earlier a user understand a product's capabilities, the better they perceive how it will affect their work and help them see why certain features are designed a specific way (Preece et al., 2015).

Considering the challenges mentioned, performing requirement analysis to understand what the "real requirements" is imperative to avoid significant alterations and rework. A user-centered

approach can ultimately help software developers discover and extract the "real requirements." Still, the biggest challenge is that these requirements might differ from the ones collected, or be missed entirely. Nevertheless, a lack of design flexibility and monolithic architecture could be crucial weaknesses, as users might change their minds.

2.2 Free and Open Source Software

Open Source Software (OSS) is a term used to describe that a software's source code[1] is open and available for anyone to see. The fundamental values of OSS are that the users should be able to use, inspect, modify, and distribute source code as they see fit (Schweik and English, 2012). Free software shares these beliefs but separates in its core vision as software should be free as in freedom[2]. Although the common conception is that FOSS is free of charge, the fact remains that a large amount of all OSS is free of pricing and that the divergence between free software and OSS is in their core vision. The term Free and Open Source Software describes software which is both free and open source. One of the largest influences in the field of FOSS is Richard Stallman, who in 1985 founded the non-profit organization Free Software Foundation (FSF). The two open source organizations FSF (Free Software Foundation, 2018) and the Open Source Initiative (OSI) (Open Source Initiative, 2007) tend to disagree on their definitions. Still, the two approaches remain almost identical and are mostly used to separate the difference in their ideologies. In this thesis, the term FOSS will be used as there is no need to consider the different perceptions of the definitions.

As for any creator of original work, licenses grants exclusive rights to the owner and limitations and conditions for others to use the work. Several licenses exist to meet these needs, and two of the most common in regards to FOSS are the General Public License (GPL) and the Berkeley Source Distribution (BSD) (The Linux Information Project, 2004, 2005). GPL is one of the most widely used copyleft licenses. Copyleft differentiate from copyright by allowing anyone to use, modify, and distribute content as long as it remains under the same licensing as the

[1] Source code is the original written version in a designated programming language. Primarily, work derived from the source code includes original, modified, improved, extended, reordered, or translated source code

[2] The term is known to be ambiguous, as there is a common misconception that the word "free" is used for describing the cost. This has led the French-English part of Europe to use the word "libre" instead of (Free Software Foundation, 2004)

original. In comparison, BSD is a liberal and simple license for software to use and freely modify, also in proprietary software. Developers cannot argue or claim ownership of modified work, nor sue the original developer if the software does not work as expected or desired.

The next section will look at how open source came to exist and in which contexts it proved to be a success.

2.2.1 Brief history

The open source culture surfaced in 1945 by students who enjoyed building and playing with software, but mostly open source dates back to the beginning of ARPAnet[3] in 1969. As open source enabled information exchange and collaborative work, its influence and technological advances created an attractive network for people (Raymond, 2001a). One of the first FOSS that emerged and formed a path for further development was the operative system (OS) Gnu is not UNIX (GNU), a free-to-use clone of UNIX founded by Stallman. GNU both shaped the open source movement and advanced the technology, and its development became a major focus in the field.

With a rise in the 70s and 80s, the community faced adversity by the 90s, as desktop computer software became challenging to distinguish. Even with many successful components and complex parts of the OS, FSF had failed to develop a GNU kernel. At the same time, major companies such as Microsoft positioned themselves in the market. Raymond (2001a) believed that divisions in society arose when many felt the lack of recognition and prosperity of the work they performed. However, in 1991 Linus Torvalds developed a free UNIX kernel and assembled developers to deliver a full-featured UNIX known as Linux. It competed for the stability and reliability of many commercial OS and became the most central activity for the community in the 1990s.

2.2.2 Development approach

Eric S. Raymond was for a long time involved in OS-development, both with UNIX and being one of the first GNU contributors (Raymond, 2001b). He never thought that Linux was a tech-

[3]The first computer network, today known as the Internet.

nological revolution, but was fascinated by how a relatively conservatively and simple, practical approach paid off in terms of quality. He illustrated his former development approach as a cathedral[4], as he believed that building large and complex systems required a centralized and well-arranged approach. On the contrary, the development of Linux consisted of rapid releases and high development pace. Torvalds delegated responsibility with a haphazard involvement of developers with a profound sharing culture. Raymond resembled it as a Bazaar[5]. Previous high rates of project failures indicated skepticism towards the decentralized approach, and there is no doubt that it can be very demanding to control large communities with massive amounts of labor-force. However, many users demonstrated that a need was served, and a lot of the users were developers. Compared to proprietary software, businesses and companies would struggle to hire the same number of people contributing to a large open-source community. It was initially a UNIX tradition to engage new co-developers, and an increasing amount of developers delivering more work scaled the system up to the expanding number of users. Ultimately, the source code was over the years refined until everything was paraphrased, which also indicated a low threshold for change. Another aspect of the sharing-culture was the debugging approach that minimized bugs.

Even though open source development has provided several pointers for what might be a successful recipe, it is questionable if its existence is bound to specific framework and conditions. An article on successful Open Source systems suggest that structure and funding are fundamental to growth[6] (Kohn, 2017). Noteworthy, many successful systems produced with FOSS are closely related to software development, like MySQL, Apache HTTP Server, Linux and all of its distributions, as well as several browsers. This fact is perhaps closely connected to FOSS having end-users functioning as co-developers. However, this may not be achievable for all possible development projects. There will not suddenly be a significant number of users ready to contribute to the available source code. The contributors' backgrounds can also be questioned, as one has to trust and have confidence in their efforts and work, and their motivation to do a good job. Moreover, if society cannot provide insight into the development, demands, and bugs

[4] an analogy of the establishment of monumental buildings, that should be constructed wisely by elected architects and builders, with a definite release

[5] an analogy of a receptive blend of disorganized agendas and approaches

[6] many popular and well-used systems such as the Linux Kernel, Kubernetes, .NET, AngularJS, React and Docker have backing from big companies and foundations

themselves, they must be able to gain insight from the outside. It may indicate that open source will not work as well in all contexts.

2.2.3 FOSS communities

FOSS is embellished as an open and inclusive society, and many programmers collaborating on big projects should indicate a low threshold to participate. However, Nafus (2011) points out a strikingly low share of females in FOSS. An open dataset from the 2017 Open Source Survey further showed that respondents were demographically 95% male, 3% female, and 1% non-binary (Geiger, 2017). These numbers, as Nafus claims, imply a gender homogeneously OS community, and that its "openness" should lead to a more even distribution. In theory has FOSS an apparent absence of underlying requirements and barriers, such as education, occupation, and time commitment, which should further generate a diverse user mass. The author states the way FOSS advertise how open they are, actually worsen the fact that women are excluded and neglected. A study from Ghosh et al. (2002) also backs this statement. Furthermore, Vasilescu et al. (2015) suggest that increased gender diversity and varying experience in software teams provide higher productivity, presupposed by relevant experience in software development. Investments in education and professional training for female programmers would likely result in overall value in both an economic and societal scale.

A big data study from GitHub tried to combine qualitative data about gender bias in open source. GitHub[7] is today a flagship platform for open source development, collaboration, and social coding, and it offers significant research potential (Gousios et al., 2014). The study discovered that women's contributions tend to have a higher acceptance rate than men's except; when the contributors were external from a project, and when identified as a woman. Their findings imply that bias against women exists, even though the women on GitHub seems to be qualified. They suggested that women were more competent on average because those contributing already were very involved in the field with both experience and education (Terrell et al., 2017). This study is not the only case in Open Source presenting a one-sided community, as about 16% of the respondents were ethnically or nationally a minority. According to Finley (2017), the

[7] GitHub is used by 2.1 million businesses and organizations, 31M developers with 96M repositories worldwide as of October 2018, from https://github.com

statistics from the Bureau of Labor Statistics (2017) in the United States showed that the number of developers, both female, and not ethnically white programmers in labor was notably larger than the numbers contributing in FOSS. The survey implies that open source contributions are vital for landing jobs, and this creates an imbalance in the technology industry as already underrepresented groups in the job market struggle even more. All these factors paint a picture of the disparities in the community today. The question remains why a diverse attendance in FOSS is missing to this degree. To further look at how the culture exists in the community, and what motivates them to participate could enlighten the lack of diversity.

2.2.4 Culture and motivation

To understand the motivation behind FOSS, researchers have asked themselves how this phenomenon came to exist; why people would contribute for free to the public good, and what is bringing value by involving oneself. In proprietary software, companies rely on paid employees. On the contrary, open source development presents a fairer democratic model compared to paid work. However, developers in FOSS may not have the boundary to quit as in paid labor. There could be resilience to rely on and be dependent on a system to deliver and continue to deliver if suddenly, no one has the motivation to continue to work on the system. Challenges in FOSS could be to know how to enhance stability and persistence to continue to deliver. Also, in FOSS, where software stems from the ideas and prototypes of others, one rarely have complete authorship compared to developing a system that is an entirely personal creation (Raymond, 2001b).

Krogh et al. (2012) explains how motivation in FOSS is lacking, compared to proprietary software development. In most cases, proprietary software highly relies on pay and career incentives, which works as an extrinsic motivation for its employees. He states that when extrinsic motivation is excluded, motivation must exist intrinsically. Hippel and Krogh (2003) suggested that these could be practical benefits such as solutions, as well as learning and enjoyment. Lerner and Tirole (2005) reckon that recognition and career aspects could motivate open source development, as it is attractive to contribute to a successful system. They would also receive great attention in the community.

Successful FOSS-projects such as Apache and Mozilla have also received increased attention

from companies that are paying their employees to contribute. Roberts et al. (2006) further examined the interrelationship between motivation, participation, and additional performance in the Apache community. The correlation between motivation and participation is clear because motivation attracts and sustains participation. However, further examination shows that past performance subsequently affects motivation. In an example of extrinsically motivated contributors coming from proprietary software, the developers have lower use-value motivations. On the contrary, they exhibit greater status motivation, as salary implied high-level contributions. Also, they state that developers with high-status motivation appear to contribute more, something the communities should encourage. The relationship between past-performance and status motivations indicates that a feedback system provides value by increasing motivations.

Bergquist and Ljungberg (2010) examined the culture of code contribution in FOSS communities to the context of the gift economy, first shed light on by Raymond (Raymond, 2001b; Mauss, 2002). Gift economy works without the typical expectation to act and trade in terms of extrinsic motivation. Instead, it sustains relationships between groups and individuals. Further, in the gift economy, the social aspects and dynamics such as norms and values have been prominent in FOSS. This raises questions about what motivates the contributors of FOSS in terms of social relations. Lindenberg (2001) suggest that motivation arises from a sense of obligation to the community. Concerning the culture and sharing processes established in digital networks as FOSS, reputation is considered the most essential aspect due to interdependent relationships. Moreover, from a social anthropological point of view, to embark in a FOSS community can have a transitional phase leading towards acceptance (Hippel and Krogh, 2003; Monteiro et al., 2004), and it is not uncommon that organizations perform ritual-like activities (Smith and Stewart, 2011).

2.3 ICT in developing countries

It is well known that developing countries face several challenges regarding underdevelopment. It could be a lack of internal resources, capital, infrastructure, stability, technology, or skilled labor. As western countries are growing in wealth and trade, developing countries continue to

receive large sums of money in loans and assistance. However, in the last few decades, there has been unprecedented growth and spreading of ICT regarding acceleration and geographic coverage. Before the 1990s, the most common key actor was governments applying IT. Additionally, there had been a lack of interest in applying ICT in developing countries, but the field has received an upsurge of interest. With the release of the Internet and the United Nation's Millennium Development Goals (MDG)[8], the Internet was reckoned a perfect supplement to achieve those goals (Heeks, 2008) referred to as ICT4D.

With limited resources, it may be challenging to know which focus areas are beneficial to invest in for improvement. There have been several efforts to strengthen developing countries throughout the years. According to the resources located and devoted, it is questionable why the situation has not improved accordingly. Several scientists have tried to address how to measure what makes a country better off than others and investigate why some underdeveloped countries seem stuck in a vicious circle of poverty that their country and citizen cannot overcome. Nevertheless, a vital aspect has been to consider whether a country's state actually gets worse, or if the gap between developed and developing countries is increasing.

2.3.1 Actions for development

It is not easy to know what could be effective focus areas for development. The economist Reinert (2007) addresses the gap as he explores why poor countries remain poor in their struggle to gather wealth, and what could be actions for development. First and foremost he states that developing countries lack incentives to invest in land or business. Secondly, they have insufficient public systems that fail to improve people's health, which eventually could increase people's efficiency and motivation. To have this in place would also be conducive to people getting an education.

Compared to developing countries, are developed countries known for economic and industrial growth. Development is often linked to both, but income is most regularly used to measure a country's development. As an indicator of total value creation in a country is measured in Gross Domestic Product (GDP)[9], GDP per capita for a year is seen as the level of prosperity for

[8] The predecessor of today's SDG, which ceased in 2015

[9] GDP: Sum of gross value added by all resident producers in the economy, plus any product taxes and minus

the average resident. However, Sen (2001) is generally skeptical towards development with the goal of increased GDP per capita. In his exploration, he dismisses the correlation between income per head and the possibility to live long and well. He states that some poor countries, in terms of GDP per capita, have prominently higher life expediencies (Sen, 2001, p. 6). Therefore, he examines how individual freedoms: freedom of political participation, to receive basic education and health services, could be critical components of development and contribute to economic growth.

Another example of essential freedoms that Sen (2001) points out is free trade in the spirit of Adam Smith. He acclaims the role market plays in development to contribute to economic growth and wants to measure its importance as valuable freedom rather than the accumulated wealth. On the contrary, Reinert (2007) believes that this freedom works against its purpose. Developed countries gradually introduced a transition to free trade after trading blocks, tariffs, and subsidies have protected themselves and their industry. He claims that this has allowed rich nations to specialize in being rich. Meanwhile, developing countries have not had the opportunity to establish the same economy that developed countries did to become prosperous. Instead, they are imposed on an economy that condemns them to increased poverty. Developing countries do not have the same ability to compete for goods, nor the ability to be competitive as they lack incentives and labor. In practice, free trade will mostly benefit countries competing on equal footing. This asymmetric relationship, Reinert (2007) states, causes the developing nations to specialize in being poor, which challenges developing countries to grow and reach stability. He argues, from an economic perspective, how developing countries are condemned to poverty as they do not "learn" how to manage themselves. Just helping them is a disservice, and that the right action is to teach them how to do it, a measure which could be worthwhile for both parties.

2.3.2 ICT4D success rates

In developed countries could funding be provided either by the government itself or the company requiring the system. And as mentioned before are developing countries in contrast reliant on external donors, aid money or loans (Heeks, 2017), and help with facilities and workforce.

any subsidies not included in the value of the product

When countries are dependent on others for the completion of systems, the already high risks of system failure could more easily amplify. There is always the risk that the funding will end, or that a project could be shut down without having had the necessary time to mature. Consequently, Heeks (2002a) claims that:

> "Most information systems – including current ICT projects – in developing countries fail either totally or partially."

This statement is based upon his own success criteria, and he states that the number of unsuccessful projects is higher in developing countries compared to developed countries, also concerning eGovernment projects (Heeks, 2003). Despite high costs and the incidence of failure, eGovernment has had a growing trend. He emphasizes the importance of a project's success, as eGovernment success will provide designated benefits, corroborate time and money spent, but also incentives future projects. Nevertheless, a tendency has been lack of awareness of failure costs, as costs neither have been published or tangible explained.

The World Bank estimated that 50-70% of their ICT projects were unsuccessful (Independent Evaluation Group, 2012). Many were astounded that the World Bank, who mainly does ICT4D projects, had such high failure rates. However many failed to notice that this indicates quite a success rate as well, between 30-50%[10] Furthermore, the World Bank concluded that approximately 50-60% of its projects achieved their ICT-related goals, To understand how a project can succeed in their ICT goals, but still be considered a failure, one has to examine its evaluation criteria. Although there is a lot of disagreement and uncertainty on how to calculate the success of a project, many have turned to the Chaos Report, which has three categories: Successful, challenged, and failed Standish Group International (2015). A successful project is completed and reached all goal initially specified, while a challenging project is completed and operational, but failed to reach all initially specified goals. Lastly, a failed project is canceled and never completed. It is still questionable how the report is summarizing both the challenged and failed projects to count the number of "unsuccessful" projects.

It is also essential to remember that the challenged projects may have a fully functional project. It is common knowledge across all disciplines that the estimation of both cost and

[10]This number is higher on average compared to other research, amongst them the Chaos Report from the Standish Group.

time at the beginning of a project commonly results in wrong numbers. During a project, there are hundreds of factors that may change or influence these estimations, and delays are often inevitable. Several research papers recommend not using the Chaos Reports numbers, but as it is the most used standard, and considering the amount of research based on these numbers, it is essential to reflect on the usefulness of this as a way to calculate the success of a project, and whether it provides any new information to the field.

Studies comparing the success rates between the United States and South Africa found the difference in success rates to be marginal (Marnewick and Labuschagne, 2011). All the while, success rates are increasing. Sonnekus and Labuschagne (2004) have similar findings. South Africa does not necessarily fit the typicality of a developing country. However, the major differences in the IT industry from the USA in both size and experience, suggest that an increased risk of failure is not necessarily affiliated to ICT4D projects. Furthermore, the numbers in the Chaos Report shows that the failure rates when looking at different areas of the world does not differ a lot, with the failure rate being between 18-20% Standish Group International (2015). Since the failure of ICT projects is subjective, it is hard to map the exact reasons some projects fail. There is, however, usually some common denominators between these projects across industries and countries. Some of these classic mistakes can be classified into the following categories: People, Process, Product, and Technology. These categories are mention both by Nelson (2007), who writes about common mistakes and best practices for IT projects, and The World Banks analysis on their ICT4D projects (Independent Evaluation Group, 2012). Other projects as well, point to lack of management underestimating both cost and time, a lack of mapping domain and requirements, and problems due to both scalability and sustainability.

2.4 Education for development

Both Sen (2001) and Reinert (2007) argues that beneficial actions could be to focus on public system's, to increase their motivation and freedom to get an education. Education generates money, both to people in labor and the country and thus provides a foundation for development. Ozturk (2001) also mentions several positive outcomes of people getting an education: it can increase productivity, lead to better health and care, enhance trade, and induce greater

returns on human capital and more. It is, therefore, seen as one of the best measures aimed at strengthening sustainable economic development within a country.

Also looking back at freedom in FOSS development, Bob Young wrote about the advantages and importance of it in his foreword in "The Cathedral & the Bazaar" (Raymond, 2001b). He believes that the freedom of available technology utilizes fast innovation as people can exploit and explore technology. Fast innovation and technical advances set standards and create patterns that influence future technology, which is essential for both hardware manufacturers and the consumers of software. Both the society and its infrastructure use and are increasingly dependent on such programs. Developing software is increasingly critical with growing implications of non-reliable and low-quality software. Historically, a significant part of the industry used proprietary software licenses that gave them more power and control. Young debates that it restricts access and restrains education and freedom for people and that proprietary software is just a legal way to limit the knowledge to our society's infrastructure.

2.4.1 EMIS

Information can be made useful to support specific tasks and to reach a decision when bundled with knowledge. The main purpose of a Management Information System (MIS) is to gather and provide access and overview to amounts of data and information to relevant managers, stakeholders, and decision makers (Stair and Reynolds, 2013). Better systems and more accurate information could radically simplify and streamline authorities' efforts to improve their services. The increased use of ICT and MIS has emerged into improving organizational activities in the public sector, corresponding with eGovernment[11] (Heeks, 2003). Wako (2003) defines a MIS in an educational context (EMIS) as a system

> "to collect, organize and report accurate, relevant and timely data for planning and decision-making purposes, and to promote the use of information for educational development."

To substantiate the definition from Wako (2003), a two measure of an EMIS' success is added from Hua and Herstein (2003): to support data integration and data sharing across stakeholders

[11] To improve public sector activities through the application of digital tools and technologies

and to make effective use of data and information for policy decisions. EMIS initially provided information about number of schools, enrollment levels, and the number of teachers. However, there are ever-increasing demands and expectations for transparency to demonstrate value for the resources used. As policymakers are under increasing pressure to make informed decisions in response to demands, this also impacts the demands of information (Powell, 2006). But there are certain conditions to keep in mind for the practical implementation of EMIS. Hua and Herstein (2003) underlines a prerequisite to continually monitor and evaluate data and information in the educational system in order to know what to collect, whom it should support, and which departments and units to include. It has also become vital to consider the level of quality when developing software.

2.4.2 Information Quality

Data can be considered facts presented in an understandable manner such as text or numbers. When data is put into a context, such as dates and locations, it becomes information (Stair and Reynolds, 2013). Further is concise and meaningful information considered information quality (IQ). For the sake of this thesis, the distinction between data and information quality will not be further distinguished, and hereafter referred to as IQ. Insufficient IQ is mentioned as a key factor for the failure of IS (Fehrenbacher and Helfert, 2012), and in one of the most recognized success-model from Delone and McLean (2003); Delone and Mclean (2004) is IQ one of the variables determining the success of information systems. Adapting the definition of quality, IQ can both be defined from an information consumer's perspective and data perspective (Ge and Helfert, 2007). It is necessary to address the drivers of IQ, which is often IT and cost, to determine which data should be collected. Identifying key information to collect and be able to analyze the appropriate data is crucial. Data collection, storage, and analysis cost money, and collecting unnecessary information not only costs but prevents important data from being correctly analyzed due to information overload. This thesis will address some of the IQ characteristics proposed in table 2.1, adapted from (Toussaint et al., 2017) with inspiration from (Fehrenbacher and Helfert, 2012) and (Stair and Reynolds, 2013).

Fehrenbacher and Helfert (2012) examined some contextual factors influencing the perceived importance and trade-offs of criteria in IQ. Their research suggests that individuals' per-

Table 2.1: IQ Characteristics

Characteristic	Description
Accurate	The information is error free
Accessible	Information is easily accessible by authorized users, in the right format
Complete	The information contains all the relevant facts
Timely	Information is available when needed
Believable	Information can be trusted
Secure	Information is unavailable for unauthorized users
Consistent	The same information is represented the same way
Concise	Information is to the point

ception is influenced by distinct factors, including the underlying ICT, the resources available, and the decision environment. Toussaint et al. (2017) concluded that IQ is a multi-modal subjective assessment, where contextual factors determine how the characteristics contribute to the overall outcome. It is therefore relevant to adapt information quality models to consider components of information that are useful to particular users in particular situations (McNab and Ladd, 2014). However, Toussaint et al. (2017) researched that a system with high perceived success, still offered room for improvement of IQ. They questioned that when replacing an old, inefficient, and ineffective system, everything could be perceived better than the old way of doing it.

However, ICT in developing countries introduces a range of different challenges and issues that may not be present in industrial countries. Common necessities could be scarce or difficult to acquire. Most noticeable are facilities which directly depends on electricity, hardware, Internet and other technicalities. For a successful project or implementation, it is crucial to map these issues and create a strategy to overcome them while being aware that other challenges may arise along the way. When designing systems, there are likely conceptions and assumption from stakeholders of what the project should achieve. The design-reality gap (Heeks, 2002b) is concerning the underlying distance between the current realities of a situation and the outcome. Heeks (2003) have from an analysis of eGovernment projects provided a model summarised by the ITPOSMO acronym. The model in Figure 2.2, represents the seven dimensions: information, technology, process, objectives and values, staffing and skills, management systems and

structures, and other factors as time and money. All factors aim to provide an understanding of the design-reality gaps. Altogether, Heeks puts forward that the dimensions are key factors for success and failure of eGovernment. The more significant the gap, the higher the risk of failure, and the lower the gap, the higher the chance of success. An example of failure could be that the system produces information that the decision-makers ignore.

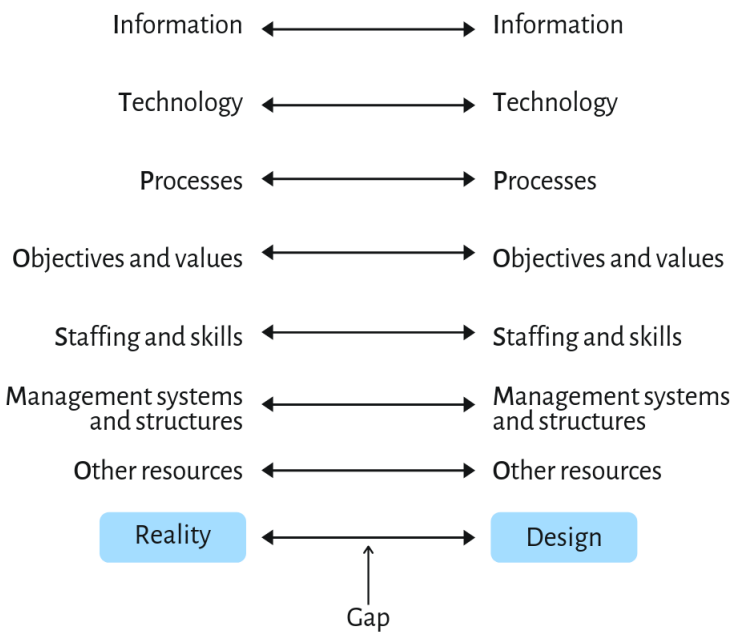


Figure 2.2: Design-reality gap model, adapted from (Heeks, 2002b, p. 105)

Chapter 3

Research background and context

"For us to get an overview of how the school works and manages daily routines, we got to observe a classroom and teaching situation at the urban school. In the second half of the class, the pupils were going to solve math problems. The teacher wrote the problems on the blackboard and asked them to write down the answers in their notebook. 5-6 children were going to cooperate on the tasks together, but not one had a notebook. Only one boy had a pencil that he started writing solutions on his desk with. I picked up my bag and pulled out a textbook and some pens, and started tearing out sheets which I handed out to the children."

- Excerpt from field diary, 12th March 2019

This chapter introduces The Gambia as our research background and context. First, there is a brief introduction to the country, followed by a closer look into the educational sector. Further is the effort to highlight and contextualize environmental and infrastructural challenges within the country and introduce the two schools encountered during our field trip.

3.1 The Republic of The Gambia

The Republic of The Gambia is the smallest country within mainland Africa and has a population of approximately 2.1 million people. It is located around the Gambia River on the western coast, surrounded by Senegal (see figure 3.1). Similar to many other African countries, it was initially an oppressed country as different empires argued about the rights to the Gambia River and the tradeable goods within the state. In 1765, The Gambia became a part of the British Empire along with Senegal. When the United Kingdom abolished the slave trade in 1807, they attempted to end the slave trade in The Gambia. The British took a strategic location at Kunta Kinteh Island (Access Gambia, 2019), and it played such a significant part in history that the island is now on the UNESCO's world heritage list (UNESCO, 2019). The country's history has made tourism a large part of the economy, along with the tropical climate and wildlife.

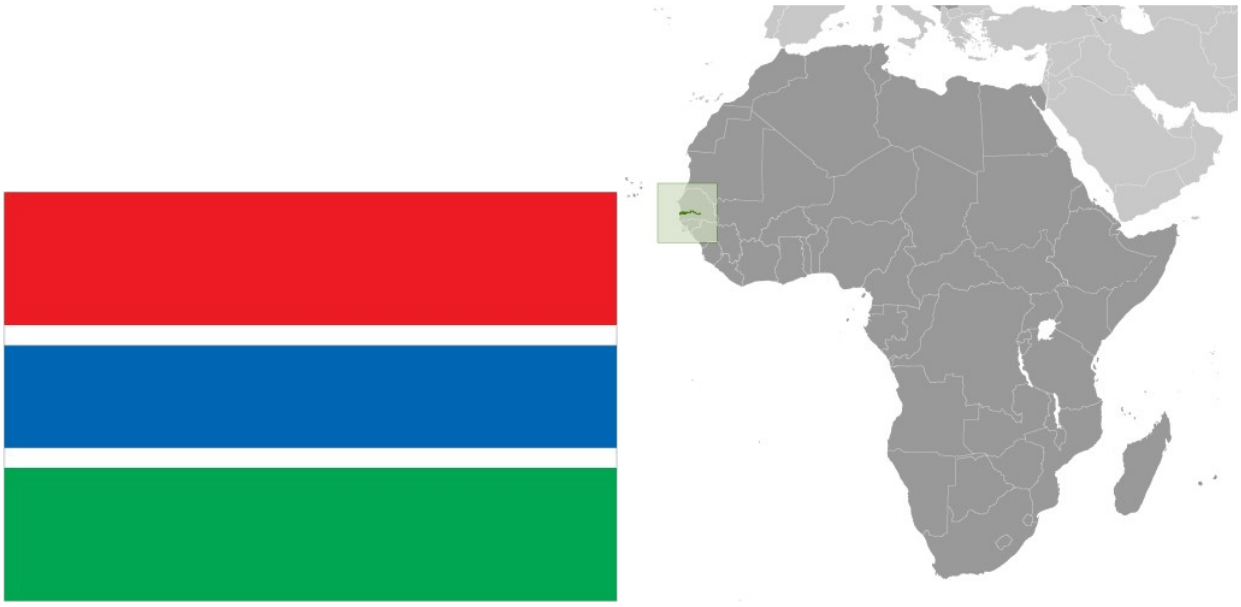


Figure 3.1: The Gambia flag and location (Central Intelligence Agency, 2019)

Figure 3.2: Map of The Gambia (Central Intelligence Agency, 2019)

However, the country has faced several challenges in recent years. A big constraint is that a significant part of the economy is agriculture, which is periodically adversely affected by droughts and heavy rainfall. The Ebola crisis in 2014 and recent political crises have made the country extra vulnerable. High fertility rates and persistent demographic pressure has additionally left the country financially constrained (World Bank Group, 2017). Besides, low health and education outcomes have placed the country in the "Low Human Development" category, ranked in 174th place of 189 countries in Programme (2016). To further highlight challenges within the country, an estimated 62.3% of the population lives below the poverty line. The educational sector is affected by the people having a literacy rate of around 55% (Central Intelligence Agency, 2019)[1], and isolated the female population has a significantly lower rate. Moreover, only 18.5% use the Internet.

The Gambia has a youthful population distribution, as illustrated in figure 3.3. It is represented by a high proportion of children and a low percentage of elderly, with 36,97% being 0-14 and 20,31% being 15-24 years old. Therefore, almost 60% of the population is under the age of 25, and the fertility rate persists at nearly four children per woman. This distribution is often typical for developing countries with high fertility, high mortality, and shortened life expectancy

[1]Definition of literacy: age 15 and over can read and write (2015 est.)

due to poor health care and sanitation facilities. Besides, little use of contraceptives and the low rate of females in education causes high population growth (Central Intelligence Agency, 2019). Late birth registrations are also a prevailing trend in African countries, a trend that is also evident in The Gambia (NIDC, 2018). Many children do not have a birth certificate because parents do not have incentive or reasons to register their child, and several citizens register their birth as adults.

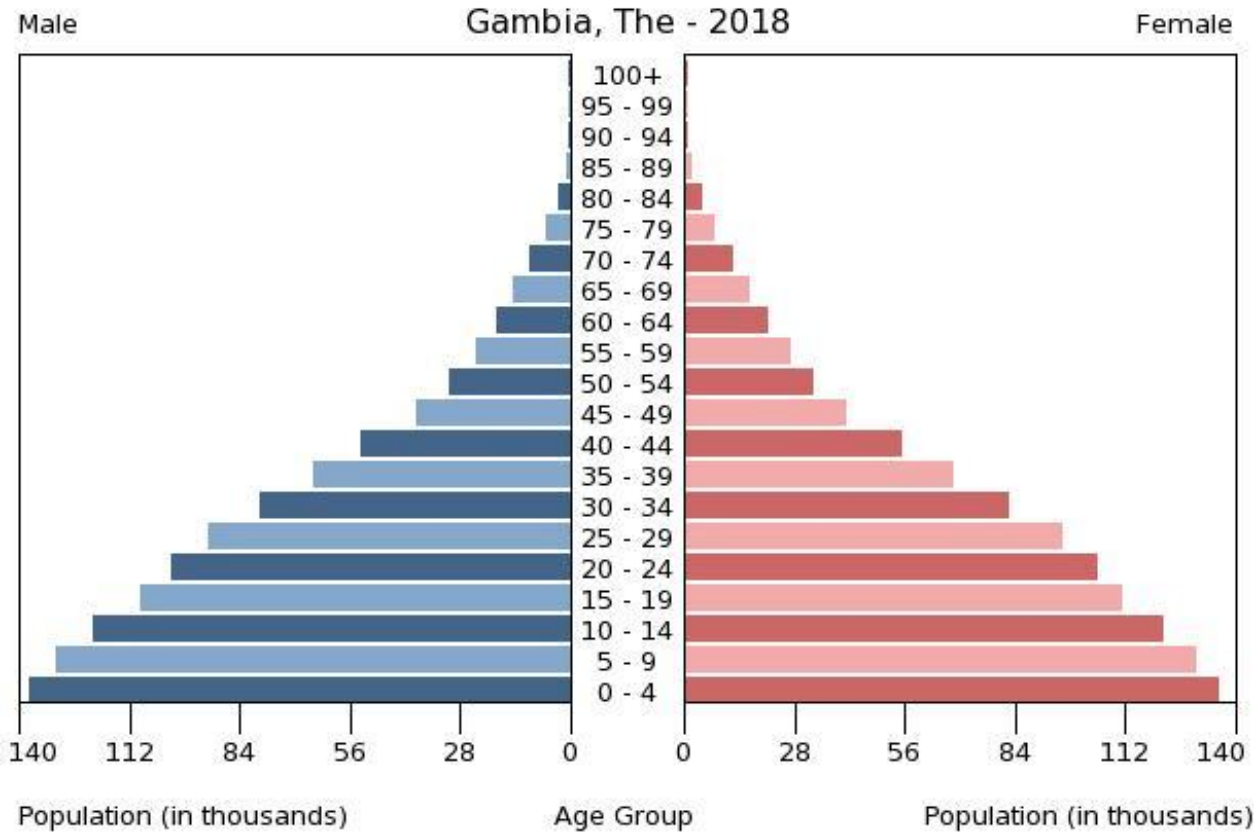


Figure 3.3: The Gambia population pyramid (Central Intelligence Agency, 2019))

3.2 Education

The Gambia's children's right to education

As pronounced in the Gambia Constitution (Human Rights Library: Gambia, 1997), Act 30 of 1994;

All persons shall have the right to equal educational opportunities and facilities

and with a view to achieving the full realization of that right-

- *Basic education shall be free, compulsory and available to all;*
- *Secondary education, including technical and vocational education, shall be made generally available and accessible to all by every appropriate means, and in particular, by progressive introduction of free education;*
- *Higher education shall be made equally accessible to all, on the basis of capacity, by every appropriate means, and in particular, by progressive introduction of free education;*
- *Functional literacy shall be encouraged or intensified as far as possible;*
- *The development of a system of schools with adequate facilities at all levels shall be actively pursued.*

The education sector in developing countries often considered a part of public services that could be deficient in regards to several factors. The Gambia is currently taking steps to improve the quality of life and advance the country. During the last years, the government has had ongoing commitments to the education sector. Among efforts, there have been gender parity achievements in all levels except higher education. Despite several improvements, some performance indicators remain low as resources also are profoundly limited. World Bank Group (2017) highlight some of the main challenges. Due to high population growth, the number of enrolled pupils is increasing. Nevertheless, the number of pupils with access to primary education has remained low. There is little improvement on the vast differences in accessibility to education across geographical areas and social-economic groups. In rural areas, such as region 5 and 6, 1/3 of all children in Upper Basic Education are not in school. As mentioned, The Gambia's constitution includes providing primary education for everyone. However, a lack of resources and education infrastructure has earlier prevented the implementation of free and compulsory education for all children. An education sector analysis in 2010 underscored a high cost of education by household. Gradually, free education was introduced from primary up till upper secondary during 2013-201. In the whole country, the persistence to the last grade of primary school was 74% in 2015, challenging the goal of universal primary education for all

children. Cultural and religious barriers are also pointed out as essential challenges that need to be faced.

3.2.1 Education Structure

There are two education ministries in The Gambia; the Ministry of Basic and Secondary Education (MoBSE), and Ministry of Higher Education Research Science and Technology (MoHERST). MoBSE is responsible for the administration and coordination of public action regarding Basic Education. In cooperation with local authorities considered the six regional education directorates, they have multiple agencies to handle the concrete implementation of policies. As illustrated in 3.1, the educational system consists of four levels. First is the Early Childhood Development (ECD), followed by the Basic Education, which includes Lower Basic Education (LBE), also referred to Lower Basic Education (LBS), and Upper Basic Education (UBE), also referred to Upper Basic Education (UBS). This is followed by Senior Secondary School, which consists of either Senior Secondary Education (SSE) or Technical and Vocational Education. After SSE, it is possible to move on to university education. Regardless of school level, the total number of schools in The Gambia was 1688 in 2018.

Table 3.1: Educational system in The Gambia

School level	**Years of education**	**Age**	**Grades**
Early Childhood Development (ECD)	3	3 - 6	1st - 3rd
Lower Basic School (LBS)	6	7 - 12	1st - 6th
Upper Basic School (UBS)	3	13 - 15	7th - 9th
Senior Secondary Education (SSE)	3	16 - 18	10th - 12th

As seen in table 3.2, the academic year runs from September to July and is divided into three terms. Still, external factors could affect this, such as natural phenomena and varying crisis challenging the country. The educational system is largely based on the British system (MoBSE, 2018), and not long ago, the primary school age was lowered from 8 to 7 years. The schools usually operate with both morning and afternoon shifts, but this varies between schools. Due to English being the official language, teaching and learning are primarily conducted in English. Most children do not learn English at home or in ECD. Therefore, most children only speak their

local language when enrolled in school, and all pupils are registered with their different native tribe languages. Pupils are divided into groups to practice their local language in a subject in class. It is not until 4th grade in LBS that all subjects are taught in English. Language barriers could be a problem, but most of the teachers understand several of the native tongues. However, there is a vast number of tribes, and sometimes it is not possible to represent the whole specter of languages.

Table 3.2: Academic year in The Gambia

1st term	September to December (Christmas vacation)
2nd term	January - March/April (Easter vacation)
3rd term	March/April - July (Summer vacation)

3.3 Field trip context

The two schools visited during the field trip was one urban and one rural. The following sections will highlight some of the differences experienced with the two schools.

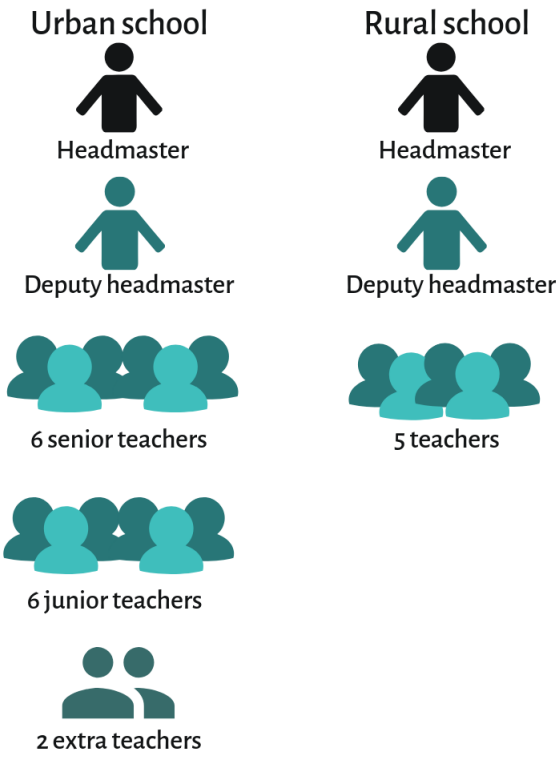


Figure 3.4: School hierarchy

Table 3.3: Overview of school differences

	Urban	**Rural**
Type	LBS	LBS and ECD
Location	Region 1	Region 6
No. staff members	16	7
Pupils	approx. 850	approx. 250
Daily meal provided	✓	✗
Access to clean water	✓	✗
Adequate sanitation facilities	✓	✗
Access to electricity	✓	✗
Adequate cellular coverage	✓	✗
Computer lab	✓	✗

3.3.1 Infrastructure and facilities

Having adequate infrastructure in a country remains significant for several reasons. It affects health, accessibility, and general well being. According to the African Development Bank Lufumpa and Lakpa (2018) The Gambia places in the top quadrant of the African countries being in 14th place of the 54 in total. Despite being amongst the best infrastructural countries in Africa, the low scores in the Human Development Index prove there are many improvements to be made when comparing to countries in other continents. It could be infrastructural challenges on both national and local level and insufficient schools conditions.

> *"The environment is conducive for learning to take place."*
> *- Teacher at urban school*

Within the country, there are significant differences when it comes to available school resources, state of facilities, and infrastructure. Often there is a matter of disparities in economic funding between public and private schools, government or grant-aided schools and traditional or Madrasah schools. Three times a year, the schools receive payments based on the number of pupils enrolled. The first term, 40%, is based on the number of pupils enrolled in the school the previous year. The second term, 30% is based on enrollment of the current year. Lastly, the third term is split into two payments, the first is 15% of the total, and the remaining 15% is based on attendance for the current year's NAT[2]. The schools supervise the funds together with the Parent Teacher Association (PTA). The PTA help decides and manages when, and on what, to spend the funding together with the headmaster. The headmaster has to file a request for withdrawal, with information of its purpose and the amount of funding required. If they run out of funding a year, they will not receive more until the next payment.

An overview of a schools' physical facilities is collected through the Annual School Census (ASC). Physical facilities include classrooms with seats and desks, drinking water, electricity, adequate and separate toilets, library and computer lab, and outdoor facilities such as fences and school garden.

[2]National Achievement Test

(a) Urban school (b) Rural school

Figure 3.5: School yard

(a) Urban school (b) Rural school

Figure 3.6: Library

Figure 3.7: School garden in urban school

Figure 3.8: Classroom in urban school

Figure 3.9: Classroom furniture in rural school

3.3.2 Electricity, cellular coverage and Internet

The leading three cellular providers in The Gambia are QCell, Africell, and Gamcel, offering effective competition. Consequently, over 90% of the country area has cellular coverage (PURA, 2017). The total amount of subscriptions per 100 inhabitants (2016 est.) is 138. However, only 18,5% of the population are using the Internet (2016 est.) (Central Intelligence Agency, 2019). Furthermore, only approximately half of the population has access to electricity, mainly in urban areas. Electricity is primarily sourced from fossil fuels, and it is quite expensive for most people. Due to both prices and lack of infrastructure in rural areas, access to electricity is scarce. Electricity is paid in advance, and is referred to as "cash power."

Urban

The urban school is located in the capital city and has adequate cellular coverage. However, at times, it could be very slow. The school is also provided with a router, but cannot afford to pay for the Internet subscription leaving them without any Internet access at this point of time. When visiting the urban school, they did not have any funding left for electricity. Therefore, they could not run the fans, which they were dissatisfied with because of the heat. Sometimes, when needed, the headmaster would pay for electricity herself.

Rural

The rural school visited does not have any electricity or facilities for it. Most of the rural areas have some cellular coverage; however, the headmaster pointed out that not everyone owns a cellphone as there is no electricity.

3.3.3 Computer lab

The rural school does not have a computer lab. The urban school did, but rarely have enough funding to buy the cash power needed to maintain the computer lab.

Urban

The urban school said they have one of the biggest computers labs with many computers compared to other schools. The teachers are not allowed to use the computers during teaching hours, nor would they have time for it. If needed, they may use the computers after school hours. Most teachers know how to use a computer; however, there are considerable differences in computer skills. Since few of the teachers has personal computers at home, most of them acquired their skills at the school.

Some years ago, a teacher was working with the school over a 2-3 year period of time. She taught the teachers how to use computers and ran tests to measure their skill level.

Figure 3.10: Computer lab at urban school

"For us to begin using a computerized system again, we will have to get trained and get practice,"

- Senior teacher at urban school

The pupils at the urban school receive basic IT knowledge. They learn how to use a computer, how to type and use a printer. Since the computer lab does not have enough computers

for all children, the class is divided into two. Then, half the class is in the library, and half the class participates in the computer lab. With half the class present in the computer lab, there are approximately 20-30 pupils supported by one teacher. The computer lab only consists of 5-6 computers, and not all were functioning properly. The pupil's prior IT knowledge varies a lot, as some have never previously tried a computer, some have computers at home and could know the name of different IT-equipment.

The urban school also has a printer, which is currently out of ink since have not filed a request for money to buy more ink yet. Therefore, when in need of printing, the teachers go across the street to print. Printing is also a cost that requires the staff to file a request for money in advance. They say that the printer is very expensive and quite old. The school expressed that it is hard for the school to maintain IT-equipment such as the printer.

> *"If we need to move it, we must disassemble it and may have problems putting it back together,"*
>
> *- Headmaster at urban school*

3.3.4 Sanitation, water and nutrition

The conditions for water and sanitation in developing countries are, in many cases, scarce. Numbers from 2014 in The Gambia state that water, sanitation, and hygiene-related diseases have accounted for 20% of deaths for children under the age of five. 40% of the population lack access to sanitation and disparities among regions also proves challenging, as only 32% of households have adequate drinking water. In rural areas, unprotected and insufficient wells are common sources for drinking water (UNICEF, 2014). Both schools had noticeable problems related to water, sanitation, and hygiene, factors that could help enable good learning conditions and improve the environment in schools

Urban

The urban school has two outdoor water taps that the pupils can drink from, but the drainage system is not adequate and is currently plugged. The school's sanitation facilities suffer under

the same problems as the water taps. Also, the cleaner does not always show up; in those cases, the standards are not maintained as they should be.

(a) Urban school (b) Rural school

Figure 3.11: Sanitation facilities

(a) Cooking ground (b) Water tap

Figure 3.12: Water and nutrition at urban school

Regarding nutrition at the urban school, the children get one meal a day, around 11.30 pm. Four cooks have the job of preparing the food, which is handed out on big plates that the children share while eating with their hands. The urban school also get daily visits from parents during lunch-break, that sell candy and ice cream for the children to buy. Some of the children disappear during lunch break to help their parents to sell goods in the nearby market.

Figure 3.13: Lunch break at urban school

Rural

The rural school has no supply of clean water. There is a caved in well on the property, and there is no other source of water. The school has latrines separated by gender; however, as there is no water on the property, a lot of the pupils refrain from using these facilities. The lack of water is a significant problem in this school, and there is currently no estimate on when the well is going to get fixed, or there is another solution.

> *"They spend maybe 15-20 minutes on walking home to eat, drink or use the bathroom and then sometimes they come back late or they do not come back at all."*
>
> *- Headmaster at rural school*

(a) Cooking ground (second building from the left) (b) Well

Figure 3.14: Inadequate facilities at rural school

There is a cooking ground on the property, but there is currently no meals provided to the pupils. According to the headmaster, this leads to many pupils being late as they have to eat before they come to school, and go home during lunch break if they did not bring food.

Chapter 4

HISP and DHIS2

HISP is a global movement to strengthen HMIS in developing countries by enabling, supporting, and providing countries with the necessary tools to govern their health systems (Braa and Sahay, 2013). The movement originates from action research and information systems design projects in Scandinavia in the 70s and 80s. Over the years, the community started to actively produce technological alternatives with the use of cooperative design by involving stakeholders for better product optimization. Today, the HISP global community includes thousands of experts, and HISP UiO coordinates and maintains the development of the platform DHIS2.

4.1 HISP governance

From the initiation of HISP in 1994, the network has been funded by the Norwegian Agency for International Development (NORAD). In 2003, the HISP team re-organized as a not-for-profit company due to focus shifting towards software development and technical support rather than education and research, which is the main focus of UWC. Financial support was scarce the first couple of years, but the organization stabilized after a Service Level Agreement (SLA) with the National Department of Health in 2008.

HISP has a large number of active partnerships ranging from pure donors to governments and universities. Partnership purposes can be funding, training, development, educational, or project deliveries. For the countries using and requesting any of HISPs services, having a partnership with the government and departments, as well as the Health Ministries, is crucial. The

DHIS2 is also supported by several organizations[1].

4.2 The beginning of HISP and DHIS

HISP launched their first pilot project in South Africa following the fall of the apartheid. The racial segregation in South Africa had a significant impact on the health care system, as it induced a fragmented health system in several divisions, based on race and ethnicity. During the apartheid and up to a year after its fall (1948-1994), the health care system consisted of 14 departments on the central level, divided into "whites," "asians," "colored," "blacks," "homelands" and "self-governing states." Due to not having any national standards for data collections, every province used their own. A notable consequence of having such a heavily decentralized health system was the numerous data collection tools, procedures, and data definitions in use all over the country, something HISP aimed to solve with research and development. The project was conducted by the Norwegian members of HISP, with general support by the National Department of Health and the Western Cape Department of Health.

To meet the reforming needs of health systems in South Africa, two developers worked on creating the first version of the DHIS. The requirements were gathered from all user bases, having features and implementations released rapidly. Near 2000, the success in South Africa led to interest from several other countries. However, problems of the initial version emerged when starting implementations. Architectural constraints and system rigidity prevented successful customization to the new health domains. Thus, the development of a more flexible system commenced, resulting in the national DHIS version 1.4. While several countries implemented DHIS, the developers continued developing the system. Evidently, a two-person team was inadequate to cover the ever-changing needs and requirements. Also, despite the DHIS being open source, there was no employment of source code sharing tools as well as having no code sharing standard. The architecture was also depending on the Microsoft standard. Thus the code was not free to run. All these factors triggered another redevelopment, which would result in the DHIS2.

[1] NORAD, WHO, CDC, USAID, The Research Council of Norway, PEPFAR, and The Global Fund

4.3 DHIS2

In 2006, the first implementation of DHIS2 commenced in India, and much of the functionality was lacking as merging the different editions proved to be an enormous task. It remained challenging to make the DHIS flexible enough to suit the needs of several countries. A well-known fact since the first version when an Ethiopian team of developers created a module to suit their own needs. At that time, the development was not distributed, and the functionality was not included in the master version. Two challenges arose from this. Firstly, it created a fork, where the Ethiopian system got stuck on a previous version. Having derailed from the master, they would not benefit from any of the future upgrades and versions of the DHIS. Secondly, the module was not a part of the shared toolbox, preventing it from being used broadly. In theory, this would mean that several teams in several countries could be working on the same implementation, not being aware of each other's work. The Ethiopian example made a point of the importance of close collaboration internationally, to further avoid the waste of money, time, and workforce.

Over the years, the DHIS2 project has adapted flexibility, and developers have collaborated to bring the system forward. Implementing and adjusting to new requirements has become a large part of DHIS2, leading to the creation of successful and beneficial modules regardless of country, background, and domain. In one instance, the Indian team needed reporting and graphing tools. As they were not familiar with the newest version of the database, they hard-coded a dashboard module, which made it unavailable for other countries. The HISP team solved this by reprogramming the module together with the Indian developer team, to make it suitable for the global repository.

Later, the need for individual data arose. Previously, public health systems had recorded and reported aggregate data. As this method of doing it did not show individuals reception of quality service, it was considered essential to add functionality to review individual cases. This was done by adding a tracker module to facilitate the integration between individual and aggregated data. All types of entities, like persons or items, can be tracked and linked to aggregate data.

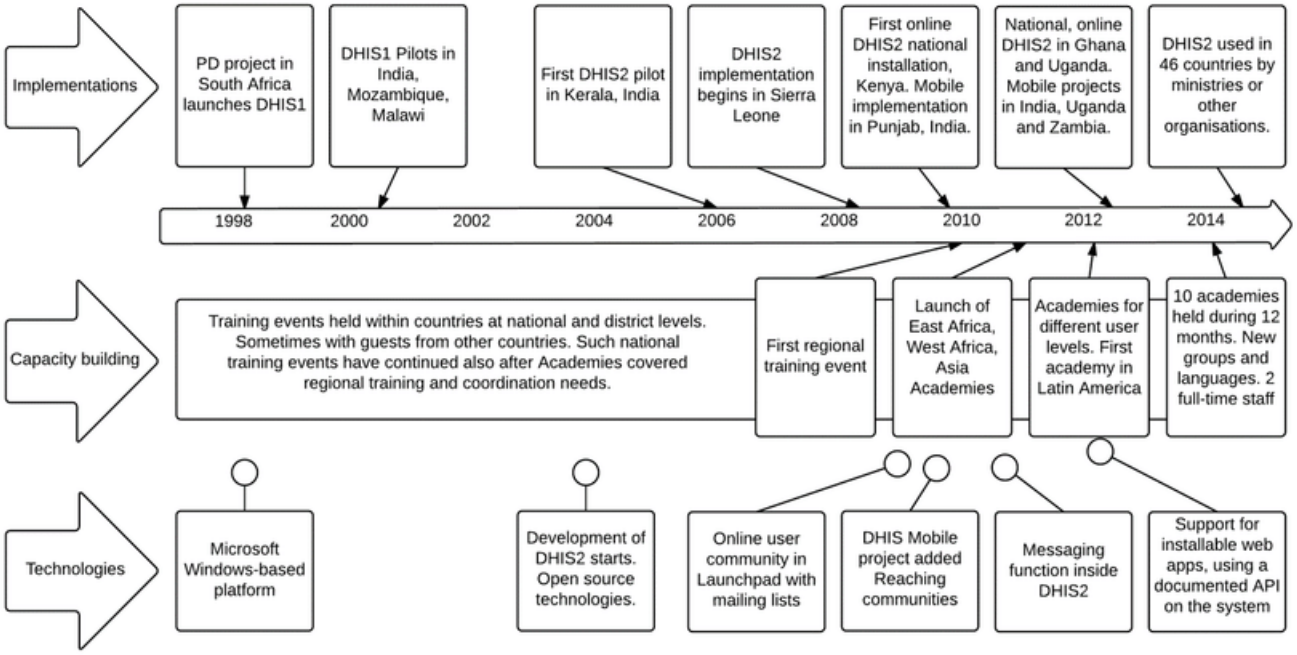


Figure 4.1: DHIS and DHIS2 timeline with a focus on the evolution of implementations, retrieved from (Roland, 2018)

4.3.1 DHIS2 today

The DHIS2 is currently implemented in 87 low and middle-income countries and is considered a WHO global public good (DHIS2, 2018) (Rolland and Monteiro, 2002) (Sahay et al., 2013). A team of developers, architects, and project managers work full time on the system. Developers are located in Norway, India, Ireland, Vietnam, Tanzania, and the United States. The system is governed FOSS released under the BSD license and is obtainable cost-free (DHIS2, 2016). According to FOSS, the users of DHIS2 has the freedom to make changes in terms of user requirements, integration, and interoperability to other software applications. To help a country's implementation of DHIS2, the HISP-network provide guidance and help through training and academies (Kossi et al., 2012), as local technology learning is an essential point in the transfer to the new domain (Braa et al., 1995), and the improvement of quality (Braa et al., 2012).

One of the most significant obstacles to providing a country with the best possible solution is the lack of insight and comprehension into a country's challenges. These challenges may include factors such as server capacity and maintenance. To cope with the various challenges facing developing countries such as infrastructure, one of the measures taken is the ability to report data via SMS. Other obstacles DHIS2 has had to acknowledge, are the legal differences in storing personal information when working with several countries. Thus, various measures have been executed to avoid conflicts and to strengthen each country's ownership of the platform upon implementation. The DHIS2 is highly customizable, and each country has the legal rights and ownership to its instance of the platform.

4.3.2 Emerging needs for mobility

There are several factors to consider when launching any software in a developing country, both regarding infrastructural and technical challenges. Infrastructure, such as electricity, could prevent the use of stationary computers. Internet connections and cellular coverage add to the complexity. People's economy also plays its part, together with the market and selection of tools. The economy has amounted in a large number of mobile phones in developing countries compared to laptop and computers. In regards to data gathering and mapping, it became apparent that the process required a lot of field work. As machines were few and far between, not being

Table 4.1: Three basic type of metadata within DHIS2

Organization units	Describe the geographical context located inside a hierarchy with administrative structure and levels. E.g., within a country, the administrative units could be at national, regional, and district level. Data entries are aggregated through the hierarchy at any level parallel and superior to its entry level. The system offers functionality such as groups and group-sets to categorize organization units, to specific customization of data analysis.
Period	Describe data with types and frequencies, such as year, six-months, quarters, months.
Data elements	The metadata explain what is collected and are designed to break down and describe events, which determines how data can be analyzed and presented. Data elements could include simple counts of supplies, or more granular data such as the number of females and males attended school in the morning and afternoon in each grade. • **Routine data elements:** Designed to meet predictable information need, and are collected at regular intervals • **Semi-permanent data elements:** Data that changes after relatively long intervals of time, i.e., annually, and further compared with routine data. • **Infrastructure data element:** Related to infrastructure such as number of supplies

very adaptive and mobile, it was not adequate to only provide computer software. Thus the option to use DHIS2 on mobile devices increased usability as well as the potential user base and eased data entry while on the move.

Still, the biggest challenges in using mobile are display-sizes, customization, the lack of processor power, and battery capacity. The market and selection may include insufficient tools regarding the standards known within industrial countries. In industrial countries, operating systems and screen sizes are often quite similar and predictable technical standards. However, in developing countries, there are significant amounts of different and obscure OS, minimizing the use of well-known Windows, IOS, and Android. Screens exist in all shapes and sizes. There are also considerable differences in the ratio of smartphones versus the old "normal" phones. The newest and most mainstream technologies and brands are expensive compared to cheaper

Figure 4.2: DHIS2 as a platform ecosystem

brands and knock-offs. Therefore, many countries have a majority of traditional hand-held cell-phones.

To address the various challenges of implementation, a dedicated development team focuses on having a broad portfolio of solutions. DHIS2 portfolio offers mobile implementation on a standalone mobile reporting system. Additionally, clients with web interfaces support an integrated HIS to secure a broader reach within a country. The platform also provides an SMS based solution, as it is the most universally available technology. There is a various selection of applications and functionalities, optimized to support several devices and screens. There are applications for offline data capture across data modules, and workers have the possibility of downloading data and charts for offline access. To communicate with an online DHIS2 instance, data can be entered during offline-mode to be stored and submitted at a later time. The focus on having optimal and straightforward solutions provides the possibility to run on cheap phones and still have the capability to roll out data entries.

4.3.3 A shift towards education

As discussed in the literature review in chapter 2, the dynamics, and the totality of adapting to new functionality rely on a platform's structure and architecture. Diverging a lot of different applications is not always appropriate or convenient, and could be harmful to the survival of the platform (Tiwana, 2014). Primarily the DHIS2 was an information sharing and analysis tool to serve the healthcare sector, but its universal design has lead to an expansion into new domains. As history indicates, the need for adaptation and expansion of the platform has been present throughout its life-cycle. From the first DHIS system to today's DHIS2, it has evolved from being a tailor-made desktop application to expanding into a modular online platform (Roland et al., 2017). There has been an ever-increasing demand for functions that were not intended from the start, which DHIS2 has provided to meet the emerging needs and desires. In order to provide a successful respond over time, new functionalities have to be built and connected to a platform core that must remain stable but allow for flexible innovation. To incorporate a modular platform with an established technology core, even the long-tail[2] can be adapted and adjusted to fit the whole (Tiwana, 2014). From serving a small number of users, which has now expanded into a large and heterogeneous user mass. From piloting in one district to distributed deployments in 87 countries. To provide reporting for clearly defined work routines for monthly public health data and, to ultimately providing analysis to a diverse range of application domains. Moreover, in this case, the DHIS2 aims to respond and diverge into a new domain. The shift towards the education sector is based on the assumption of feasibility. The implementation will be determined by existing core software, but with the domain-change must also be able to take into account changes and adjustments. The new branch can be regarded as a mutation, where the paths in the two domains continue in parallel. DHIS2 is nevertheless a system that has, for a long time, been tailored to fit the health sector. Therefore, the shift will, to a large extent be decisive according to potential differences between health and education, and to what extent the health domain can transfer experiences to a new domain.

[2] a term used for the capture of specialized and uncommon needs

Chapter 5

Current EMIS in The Gambia

"On Tuesday the 12th of March we visited a public Lower Basic School in the capital city of Banjul. We arrived in the morning when the school day had already started. During the day, we had conversations with different parts of the staff, who showed us the premises and facilities, and later gave us some insight into their daily work routines. When arriving at the school, the headmaster underlined the importance of our contribution to the pilot project. She said there should be a common understanding that together, we could help each other and equally reinforce the education domain in the Gambia and continue to develop and move forward. The school had initially asked for a solution for a digital pupil register 4-5 years ago. Therefore, the staff was pleased about being elected as a pilot school. She told us that when they had made their proposal, MoBSE did not have the required means to initialize such a project. They were very eager on digitalizing the school's data and expressed wishes to test several solutions as a pilot school to further evaluate what could be suitable, expedient and sustainable solutions at a later point of time."

- Excerpt from field diary, 12th March 2019

This chapter will present the current state of the EMIS in The Gambia, and provide insight into the process of collecting the information, with MoBSE as the responsible unit.

> "As we are in the information age, the success lies in the use of information for development. Absence of use of information for monitoring development activities results in a retarded type of development activities." (Wako, 2003)

5.1 The current solution

The national standard for EMIS is data from a paper-based questionnaire collected annually from the schools. The forms, known as the Annual School Census (ASC), are also currently the only information to be supplied back to the schools. The report does not provide any new data but is considered a useful tool over several years. The data from the ASC is also used by the MoBSE to create an Annual Year Book (AYB)[1], which features more in-depth statistics.

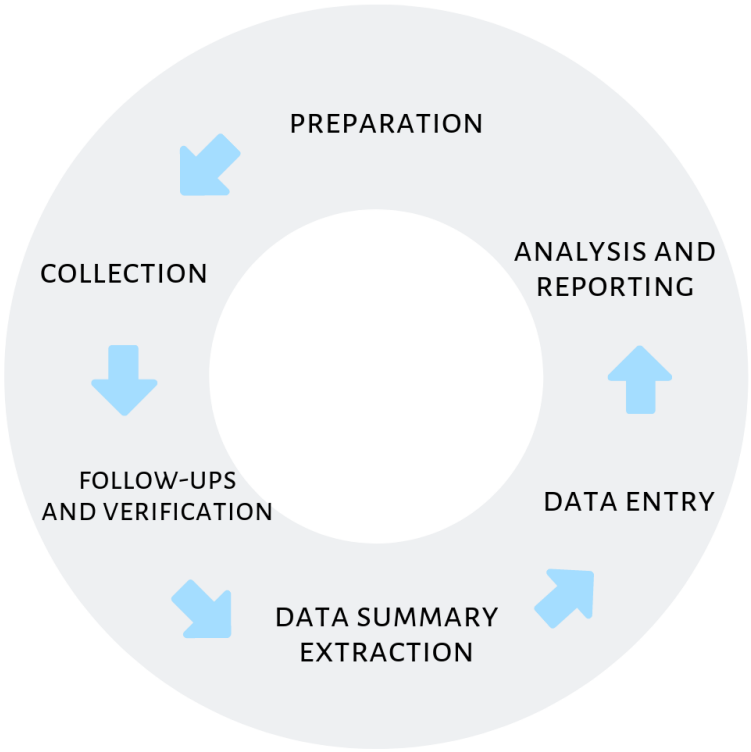


Figure 5.1: Data collection process

[1] http://www.edugambia.gm/data-area/publications/year-book-2019.html

The data collection timeline is between November and March and covers DCC, ECD, LBS, BCS, UBS, and SSS. There are separate questionnaires for each level of the school. The questionnaire covers different thematic areas such as contact details, physical facilities, the school's enrollment data, and teaching staff description. The data collection cycle is illustrated in figure 5.1, and each and every step is explained in table 5.1.

Table 5.1: Description of the data collection process

Preparation	Part of the preparations is to hold a stakeholder meeting and update the school list to remove closed schools, add new schools, and update existing schools. The last task is to print all the new forms and data feedback from the previous years.
Collection	There is a regional meeting to train the Focal Points and Cluster Monitors on basic verification checks and the filing of the questionnaires. The Cluster Monitors train School Teachers. When retrieving the questionnaires, the Cluster Monitors collect and verify all questionnaires. The Focal Points verify all questionnaires from Cluster Monitors, and the EMIS team ultimately verify all the questionnaires.
Follow-ups and verification	The follow-up is on missing forms from the schools. The verification part is to verify new information such as newly discovered schools, schools reported as closed, and to verify unreasonable differences in data compared to previous years. It is important to update the school list to remove closed schools, add newly opened/discovered schools, and update schools whose general details have changed.
Data summary extraction	Data is extracted for internal use before publishing, which includes basic data about enrollment and teachers. This is in regards to public schools only.
Data entry	The data is entered by local entry clerks with the use of EMIS data entry software with verification of e.g., empty fields, unreasonable entries, and checks trends.
Analysis and reporting	Include data extraction to pivots and the final statistics. The last task in the cycle is the production and publishing of the yearbook.

5.1.1 Limitations with the current solution

The current solution is heavily influenced by being paper-based. The collection process has several verification stages, as seen in figure 5.2. Unfilled ASC are delivered to every school in The Gambia. The filled out forms are hand-delivered from step to step. The Cluster Monitors are the first to collect the ASC from the schools. Cluster Monitors are responsible units for all schools within a small or big geographical area, dependent on the number of schools. The Focal Point is the responsible unit for each region and includes all schools in the region. Ultimately, all forms from every school in the country are delivered back to MoBSE.

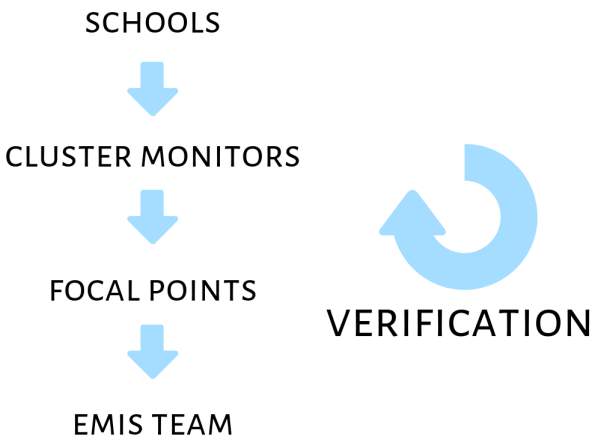


Figure 5.2: The process of collecting and verifying the questionnaires

5.2 Desired solution

The most basic requirement is to digitalize the ASC. However, to proceed entirely from paper forms to ultimately achieve the goal of a digitalized EMIS, the solution must accommodate every school with a computerized system or mobile devices to manage their data. The shift will not only comprise a decentralized approach, but it will also transfer more responsibility to the schools. For the implementation, it will be necessary to work closely with teachers and administrators to identify what additional functionalities would be beneficial in helping them perform their tasks and meet their targets. To collect data electronically, the schools should have options

for online/offline mode depending on network and Internet availability. There should also be an option for a mobile application to facilitate the provision of data at periodical requests, such as daily attendances of staff and students.

The desired system could facilitate the provision of the following data:

Table 5.2: Desired data collection

School Administration Module	To facilitate effective and efficient administration of the schools, the module should include school record keeping such as financial records, visiting logs, meeting, and minute sheets. Further, it should contain data for the administration of school building facilities and its attributes. It would also be relevant to manage the amount of academic and pedagogical resources, and manage school student admission and registration, possibly with unique student identification.
Individual Staff Management Module	The module should contain the necessary tools in the daily management of staffs, such as daily attendance, teachers time tables, and their code of conduct.
Individual Student Management Module	To provide functions to supervise the daily administration of the students in the school, such as daily attendance and assessment management to include work as tests, assignments and termly assessments, and it should incorporate student results from national tests and exams. Lastly, the module should contain full bio-socio-economic information of the students, and each student should have a nation-wide unique code assigned at the time of registration, a code that is traceable in the event of a transfer. It should also include social and economic details of students, parents, and guardians.

Chapter 6

Methodology

This chapter covers our applied philosophical foundation and research methodology, which is an interpretive case study to constitute our empirical data. Further, we analyze and reflect on our role as researchers, our chosen methodology and findings based on Klein and Myers (1999) seven principles of interpretive research. Finally, we end the chapter with some ethical considerations.

6.1 Philosophical foundation

The interpretive paradigm best describe our philosophical foundation. Hence, as researchers, we aim to investigate how a phenomenon can be influenced by and shape a social environment. During our research, we have applied a case study research strategy, which is commonly associated with the interpretive paradigm. However, our initial plan was to conduct an action research (AR) methodology. Nevertheless, our philosophical foundation has remained the same. Both AR and case studies serve multiple data generation methods, in which both quantitative and qualitative data can be used. Walsham (1995) has addressed the nature of interpretive research in IS case studies, and furthermore methods for doing such research. As noted by Walsham (2006), it is highly applicable for case studies and observation techniques that need detailed examination. An essential part of the study is understanding the context and the process, which is the educational domain in The Gambia.

6.2 Research approach and strategy

This project can roughly be divided into three periods as the first and final period coincide with a four-week field trip in March 2019. An overview of the work performed in each period will be presented in this section.

Preparation before field trip (August 2018 - March 2019)

This period mostly consisted of performing a thorough literature review. Our initial plan was to find a case and project to participate in and to read potential literature and theory closely related to it. Likewise, we planned to perform an action research (AR) methodology in the field. AR consists of an iterative cycle of planning, acting, and reflecting on a problem domain to gradually gain an understanding of it (Oates, 2006), and it implies the involvement of practitioners working in the specific problem area.

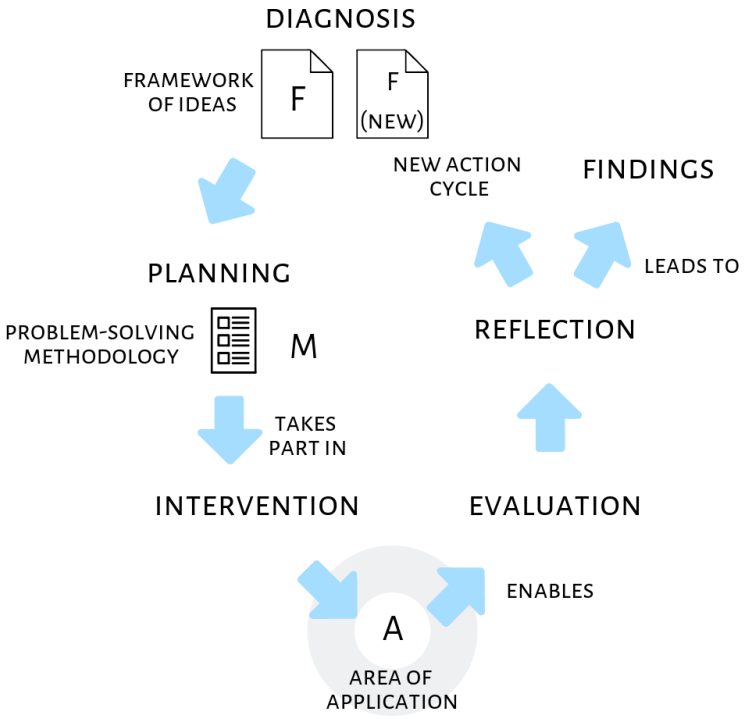


Figure 6.1: The AR process, adapted from Susman and Evered (1978), Checkland and Holwell (1998) and Oates (2006).

Figure 6.1 shows the process of AR as a cycle of five stages explained by Susman and Evered

(1978); Oates (2006). The cycle is further conceptualized in terms of F (framework of ideas), M (methodology) and A (area of application) (Checkland and Holwell, 1998; Oates, 2006). F and M correlate with the research process. F acts as a theory base for the research, and M is the problem-solving methodology that enables F to be used. Eventually, M is put to use in A; the real-world problem situation, which for us would be the field trip to The Gambia. The reflection phase consists of an evaluation where we decide what was achieved in theoretical and practical outcomes and in time, decide whether a new AR cycle would be necessary.

We estimated the trip to be two months, due to financial limitations and the thesis time perspective. Thus, when selecting our thesis topic in May, we hoped to establish our case and be ready for departure in October and return in December. However, a lack of ongoing projects with the necessary prerequisites for us to participate delayed our departure. Our initial literature review consisted of general topics regarding IS, development theory, Open Source, and more specifically, HMIS, AR, HISP, and DHIS2. In order to narrow down possible cases, the last three topics involved reviewing related work from Master Theses and research connected to HISP. Midway in the autumn semester, we decided to work on the case of education. Several countries were commencing on a pilot project to implement a digitalized EMIS. It was also an appropriate case to research, due to its new effort and little prior knowledge. In collaboration with HISP Oslo was The Gambia our chosen destination due to the likelihood of having the earliest possible departure. Before our departure, we gained some general insights from statistics in chapter 3 Research background and context, as well as reviewing the case documents we got access to in chapter 5 Current EMIS in The Gambia. Nevertheless, we had several delays before the commencement of the training, making our departure ultimately postponed to March. We had to wait for external planning, facilitation, and other arrangements for everything to set into motion.

Field trip to The Gambia (March 2019 - April 2019)

Our departure was determined by the commencement date of the workshop, which was set on the 4th of March. Given our limited time period, our arrival in The Gambia was critical in terms of the length of time we could allow ourselves to conduct the research. Thus, leaving in March, our initial plan of eight weeks was shortened to four weeks. This period was our basis of data

collection through a case study, further elaborated in section 6.3. The process of AR is highly linked to user-centered design approaches, which would have been our selected approach of AR through designing and testing a prototype after gathering requirements. However, due to time-constraints and practical reasons, we were not able to carry this out. We considered it inexpedient to make time to build and design a prototype, without having time for user-feedback to analyze the effort.

Instead, we ended up conducting a case-study. Performing a case study involved an in-depth study by applying one or several methods, which we will further elaborate in section 6.3. A case study provides an account for what occurs in a social setting, unique to a particular situation. Through our field trip, we could examine the case in its natural setting that allows us to holistically attempt to understand the contexts and interrelation of processes and individual factors (Oates, 2006). With the data collection and our research in background and context, we can further make generalizations to the extent that the chosen case is typical of other cases in comparison with related research and literature.

In general, a premise for doing interpretive research is to gain and maintain access. During our stay, we mainly interacted with two stakeholders. First, it was MoBSE, the centralized national level of the hierarchy. Secondly, it was the schools which we consider the decentralized point-of-service. During the field trip, we participated in a collaborative pilot workshop to implement a new information system with the use of DHIS2 in the domain of education. The collaboration was between the EMIS team at MoBSE and a team from HISP West and Central Africa. The workshop included training and implementation of the DHIS2 and lasted for three weeks. We followed the workshop closely to get a more in-depth understanding of the challenges and benefits of using DHIS2. All involved parties knew about our participation in advance.

We were given a considerable amount of liberties and opportunities to do what we wanted by MoBSE and could attend the workshop as we wanted. MoBSE helped facilitate our work according to our needs and desires by taking care of conversations with schools to let them know about our arrival. We visited two schools in The Gambia, one urban school in the capital city and one rural school in region 6. Representatives from MoBSE brought us to greet the school administration at the urban school in advance of our first scheduled visit. Due to its location in the capital, we had the opportunity to make several visits and could freely visit it after being

granted permission. MoBSE also arranged a two-day trip with a driver and accommodation for us to visit a rural school. The trip to the rural school was posterior the workshop so the MoBSE employees were able to join us, as we could not travel that far by ourselves. We visited the school for a couple of hours after a 6 hours drive.

At both schools, we spoke and interviewed the administration and teachers, in an informal and semi-structured manner. We brought a camera to document pictures from the school, its conditions, and facilities. At the urban school, we also observed a classroom/teaching situation, to better understand the school domain in The Gambia. During the last week, a focus group interview was conducted with the EMIS team to get their views and feedback on the software, the training, and the workshop itself.

Period after field trip (April 2019 - June 2019)

Following our return from The Gambia, we have worked on finishing our thesis and participated in a debriefing session in Oslo. First and foremost, we worked on structuring the data collected to present our finding while concurrently adding and refining literature theory to better ground and analyze our findings in the discussion.

6.3 Data collection and sources

This section will present our application of the different qualitative data collection methods, subsequently present our interview sources.

6.3.1 Data collection methods

Document analysis and meetings

We got access to documents on Google Drive and Dropbox, provided by HISP UiO and MoBSE. The documents involved project proposals and background information for the project. The documents also provided insight into the education structure in The Gambia, the current EMIS, and the desired solution. We also got to partake in two Skype meetings for us to introduce ourselves to some of the HISP stakeholders working within the EMIS domain, and to discuss our

involvement in the project.

Observation and workshop

During our stay in The Gambia, we participated in a collaborative pilot workshop to implement a digitalized EMIS. The collaboration was between the EMIS team at MoBSE and a team from HISP. The goal was to build a shared and integrated data warehouse to store and analyze data with the use of DHIS2. The training was scheduled for three weeks. The expectations for the first week was to present and explain DHIS2 to make the EMIS team understand how to use it, and what the system could provide. The goal was to educate and train the EMIS-team, and give them a thorough understanding, before implementing the second week. The HISP team facilitating the workshop embedded feedback and evaluation sessions as "help desk/drop in's," to make sure the EMIS team was following the process and learning the objectives.

Both of us wrote observation notes during our field visits in the schools and throughout the workshop. We wanted to experience the workshop from the same point of view as the others in the same setting (Oates, 2006). The first day we presented ourselves and our purposes. As we did not have prior knowledge with DHIS2, we wanted to start learning the system, sitting at the same tables as them and paying attention, using our computers to perform certain tasks. To participate in the sessions, we set up a database and server to run DHIS2. This way, we participated with the EMIS-team on equal terms like co-workers. After a while, we participated selectively, as some aspects were more relevant and valuable for us. As a lot of time was used to visit and work on information from the schools, we could not fully participate in the workshop the last weeks.

Because of our lack of insight into the school's, we let the school employees show us around and provide insight into their daily routines, and participated in a class. Being on their premises, we wanted to act respectful and take an interest in what they wanted to show us. We undertook such action when one of the teachers which were highly engaged in several school activities, wanted to show us his effort on the school garden and invited us to come to watch their local sports day, which we later did.

Pictures

A camera was brought to the schools to take pictures of the papers and documents encountered. We also used the camera to document the environment and working conditions for the context chapter. The focus was mainly on situational pictures and trying to avoid faces, but we still asked for consent before taking pictures. Despite being taken mainly for documentation, the pictures were a big help to recall our memory while reviewing our findings. This further helped us uncover elements after the interviews.

Semi-structured interviews

When conducting semi-structured interviews, we had a set of questions and topics we wanted to cover (see Table 6.1), but adapted to the conversation and raised new questions when needed (Oates, 2006). We also prepared a set of questions and topics of conversation for us to get started. By doing this, we wanted the interviewee to feel free to open up to relevant topics or issues, and we could talk in greater detail on each subject. When performing interviews at the schools, we acted in accordance to Walsham (2006):

> "sensitive to these time pressures and not overstaying one's welcome during the interview. Better to finish interviews and lose some interaction time, if interviewees are clearly pressured than to irritate them taking too much of their time."

The school interviews were conducted in pair. One was taking notes during the interview while the other was interacting with the interviewee, a distribution we had throughout all interviews. This method was chosen as it provided more freedom for the interviewer to concentrate on engaging with the interviewee. The writer could interfere if something was overlooked or forgotten by the interviewer or if a question was too leading, so we could work on it towards the next interview to make sure the answers given were unbiased.

We visited the urban school on several occasions and performed interviews based on who was available and where we would not disturb others. The environment of the interviews was, therefore often noisy, being a school with many children. Because of our time constraints, we also felt that transcriptions of interviews would be too time-consuming, time we would rather

spend on analysis. We also wanted to avoid the disadvantage of tape-recording making the interviewees less open or less truthful.

Immediately after a school visit, we read through the interview notes to comprehend its potential contribution, wrote down things that were at the top of our head, and began sorting the data. At this point, questions and answers given were reevaluated based on body language and our perception of the interviews to search for lack of information.

Table 6.1: Conversation topics for school interviews

Background information	School routines, staff, teachers work, exams, tests, pupils day, everyday challenges, language barriers
Administration and management	Layers of management, national, regional and district level, school hierarchy, communication, decision-making, PTA, school funding
School facilities and infrastructure	Electricity, water, sanitation, nutrition, cellular coverage, Internet, supplies and commodities
Data collection	Data demands, expectations, documents, registers and workflows. Meeting government expectations. Their feelings towards a digital system. User-friendliness, expediency and benefits for teachers.

Focus-group interview

We knew from the beginning that we wanted to conduct interviews with the participants in the workshop to get their insight and feelings towards the new system. Therefore, we prepared a set of topics that we wanted to bring up (see Table 6.2). The choice to have a focus-group interview with the three EMIS members at MoBSE was mainly due to time constraints. We did not want to occupy their time during the workshop, and after the workshop was completed, they had other tasks to do. By proposing to do it in a group, we would not steal to much time from their work, and it would be done efficiently. During the workshop, we also had obtained some insight into their work and could more easily generate questions to ask them.

When performing the focus-group interview, we wanted the group members to interact and make a discussion which could generate new insights they may not have thought of themselves. It was essential to facilitate the interview in order for all members to have attention and to speak freely (Oates, 2006). During the interview, one of us acted as a facilitator, while the other tran-

Table 6.2: Conversation topics for focus-group interview

Background information	Former education, technical knowledge and experience with information systems
DHIS2	Prerequisites and expectations, first-impression, layout, usability, suitability, benefits and challenges
Training	Expectations and preparations, pace, impression, challenges and bottlenecks, suggestions for change

scribed and took notes during the entire session.

6.3.2 Data sources

Our data sources consist of participating in a 3-week workshop, and our interview sources are the EMIS team at MOBSE, the urban school, and the rural school.

Table 6.3: Sources of data collection from workshop

Source	**Method**	**Frequency**
HISP 1-2 employees	Observation and workshop	3 weeks
MoBSE 3 employees	Observation and workshop Focus-group interview	3 weeks 1 meeting

Table 6.4: Sources of data collection at urban school

Source	**Method**	**Frequency**
Headmaster	Semi-structured interview Informal meeting	3 meetings
Deputy Headmaster	Semi-structured interview	1 meeting
4 Senior Teachers	Semi-structured interview	2 meetings with two 1 meeting with two
2 Junior Teachers	Semi-structured interview Observation	1 meeting with two 1 classroom observation
Headmaster Deputy Headmaster 6 Senior Teachers	Informal meeting	1 meeting

Table 6.5: Sources of data collection at rural school

Source	**Method**	**Frequency**
Headmaster Deputy Headmaster	Semi-structured interview	1 meeting

6.4 Data analysis

The next two sections will evaluate and reflect on our research. To further explain, analyze, and reflect on our practical approach as interpretive researchers, we have used Klein and Myers (1999) seven principles in our data analysis and reflection in section 6.4 and 6.5. The principles are used as guidelines, rather than mandatory rules, on how to conduct and evaluate interpretive case studies on IS. The application of these guidelines throughout our research is grounded in the study of Miskon et al. (2015). The discussion in chapter 8, attempt to cover and justify how any perception originates, based on our findings. In this section, we want to evaluate factors impacting the data collection, and how the data is interpreted, and further reflect on our role as researchers and limitations to our contribution. Based on *the Principle of Interaction*

Between the Research and the Subjects, it is essential to stress that this thesis is solely our perception, based on our interpretation, observations, experience, and empirical data (Klein and Myers, 1999). We considered ourselves neutral observers, but not unbiased as:

> "We are all biased by our own background, knowledge and prejudices to see things in certain ways and not others" (Walsham, 2006, p. 321).

We want to reflect on how the whole research process have impacted our data and collection and how our judgment and perception influenced our research approach. Prior to this thesis, our knowledge and involvement to HISP, DHIS2, and their working practice were virtually zero. This also applies to MoBSE and The Gambia, which in one way were significant for us to arrive and perform open-minded research compared to closely involved researchers, which we will reflect on later. The three principles from Klein and Myers (1999), *Principle of Contextualization, Principle of Abstraction and Generalization* and the *Principle of Dialogical Reasoning* will stress how our understanding of the case has affected the data. As explained earlier, during the preparatory phase, we tried to gain sufficient insight to conduct the fieldwork by reading and getting familiar with the case to generate further insights. Reflecting on the social and historical background of our research setting could determine what relevant context to explore, and judge how representative our case is for other cases. Thus, we contextualized our understanding of the study domain and its current state in chapters 3, 4 and 5. We also performed a detailed literature review in chapter 2 to better understand our phenomena of interest. Similarities with other cases can be based on physical location, history, social mix, scientific basis, or organizational type. However, abstraction and generalization depend entirely on our understanding of the case and how we link together and draw differences. Even with information and insights in advance, we cannot deny that our comprehension was limited. Researching in a completely unknown setting increases the likelihood of us missing important points and facets of the encountered reality. A lack of preconception to the case affected this, regarding the environment, the culture, and the people. Especially in retrospective to the insight that active involvement and participation provided. Still, it is possible that our close involvement during our stay made us lose the benefit of a completely fresh outlook on the situation, and that we unwittingly interpreted data to benefit the research. Similarly, the study could have turned out differently in

regards to our work and reasoning along the way. Progressing the field work, we interpret data with general concepts, and after we continue to draw implication for similar and future cases. Thus, everything affects the overall outcome, which depends on our ability to confront preconceptions with our findings and discover contradictions in comparison with data. Concerning everything mentioned, previous experience and awareness of the research process would, to a degree, have been advantageous.

As previously mentioned, we did not have a close relationship with stakeholders before the research but became familiarized during our stay. To shed light on our extent of involvement, it is self-evident that close involvement affects time, and could also impact the data (Oates, 2006). Therefore, we consider how our relationship with the workshop teams and interview subjects affected this study and elaborate on our participation with HISP and MoBSE. Our first encounter with both the EMIS-team and the HISP-team was on arrival. They made an effort to make us feel included, by having lunch together, making informal conversations and exchanging cultural differences between Norway and The Gambia. Most of the training transpired around the HISP-team learning the EMIS-team DHIS2. We pursued close involvement through observation for us to get in-depth access to people, issues, and data. Still, the initial plan was to not only remain observers. By performing AR, we would have carried out a cycle of prototyping and testing, probably in closer collaboration with both teams. This was not achievable due to time-constrains and the early stage of the implementation phase. However, we actively tried to pay attention, to learn and gain insight into the training process and had observatory participation in the workshop. An essential aspect for us was how we could make a valid contribution and not gather data solely for the sake of our thesis. Therefore, we remained open for input on what could be useful for the stakeholders to know more about for the EMIS-team's information about the school system, and feedback to the HISP-team concerning their training and workshop. We also provided some feedback during our stay and opinions on the practical take on the workshop to give something of value back. Still, our contribution to the implementation during the workshop remained rather scarce. There were mainly two aspects affecting this. During the workshop, we felt compromised by our limited comprehension of both DHIS2 and EMIS. Both teams had first-handed insight in both matters and could complement each other, while we attempted to gain an understanding of both. Additionally, we were simultaneously gathering and

analyzing information from the urban school, which in itself took a part of our time in addition to being a third aspect of the case for us to comprehend. We did not feel like we confused anyone by our presence and that us being there was a rewarding experience for them. The team expressed that the weeks had been fun, and one of the managers mentioned that he observed an enlightened team that arrived at work earlier than usual. He stated that we were a lively contribution to the group. As subjectivity can be a significant flaw in interpretive and qualitative research, we have attempted to stay objective and present our findings without distortion.

English is the official language in The Gambia, so language barriers were not a big problem. Still, it could sometimes be challenging to understand some words as people spoke fast and did not always articulate or pronounce the words to our understanding because of strong accents. If we considered a topic to be essential for us to hear, we would ask them to repeat what they said. At times their tribe language or other native tongue was spoken, as it was more natural for them despite English being the official language. When this happened, often we did not consider it proper to ask what they were talking about, something that could make us miss information that may have been useful to us.

To further reflect on how the data collection and interpretation affect each other throughout the study, we highlight the *Principle of Interaction Between the Research and the Subjects* (Klein and Myers, 1999). As our fieldwork builds the case study, we stress our considerations of this principle. Without a doubt, our results are affected by our point of view. It has been essential to acknowledge our influence on the initial interpretation and seek to find multiple interpretations as we will later elaborate with the *Principle of Multiple Interpretations*. Details in our research design in this chapter are supposed to enlighten readers about our impact, how we have created data in interactions with subjects, and how we have handled our data collection and interpreted our findings. We may still, to some degree, have sacrificed approaches that could have yielded its own set of valuable insights, especially concerning our qualitative approach. A quantitative approach could have yielded important insights, as we will further reflect on in section 6.5. Our approach is very subjective, and our lack of prerequisites and understanding of the setting and for people affects this and creates limitations. The *Principle of Suspicion* proved essential for us to consider during our study (Klein and Myers, 1999). It involves how there may be biases and distortion to our findings. It was vital for us to have a critical perspective during both the data

collection and analysis. In other words, not taking the informant's view at face value and to keep in mind the contextual background. There can always be aspects of the "reality" presented that need to be more thorough and critically explored. Observer bias could occur if an interviewee exaggerates negative aspects for sympathy or justification. E.g., the urban school was in most cases in favor of digitalizing everything, which in our assessment is not always necessary. There were also certain workflows and routines that we could precept as unnecessary, inconvenient, or cumbersome. Still, they might not have a problem with it, nor want it to change. This could originate from our background from a different culture and our domain understanding of "best-practice." Even though we do not see the purpose, we cannot exclude that there are reasons, as it might be a cultural difference and it could be part of the employment. As noted in the abstract of Smith and Stewart (2011)

> "Organizational rituals may be characterized as standardized, rule-bound, predictable and repetitive behaviors undertaken in conditions demanding explicit performance expectations."

Conclusively, the work could have a secondary purpose that remains unknown to us. The schools are obligated data suppliers, and we can consider it an organizational relationship between MoBSE and the schools. We had a critical mind to the reliability of our respondents' answers and their viewpoint. I.e., do the stakeholders have any benefits or incentives to respond? By not being positive, is there a risk that everything will remain unchanged? When interviewing in an organizational context, we were aware of the possibility of subordinate employees being affected by their superiors point of view. Noteworthy, we are unsure of the degree of "real" requirements collected. Moreover, it is nearly impossible to judge the honesty of stakeholders due to the number of factors that play in. One of the schools stressed that they want something in return from their effort in having us. They implied a lack of supplies, something we comprehended would ensure their participation in the pilot. Encountering different stories does not necessarily nurture credibility, and could be skepticism to our work. Previous experience with a research team, made them express wishes that our work should not only be beneficial to us but also help them. We also experienced, at times, limited understanding of our contribution. In this case, we had a short amount of time to gather requirements and did not have much time to get to know the user group. This may have caused a lack of confidence and trust. There could

also be different incentives to different stakeholders, and other forces impacting their answers, beyond our understanding.

6.5 Reflection over methods

This section will review our data collection and the chosen methodology. According to the *Fundamental Principle of the Hermeneutic Circle*, we have considered outputs from several sources and comprehended a fit of this information within the whole picture of our case study Klein and Myers (1999). How we have selected our sources and further analyzed the information, has without doubt greatly influenced our research, and this section will emphasize its limitations.

We went to The Gambia with an open and adaptable approach. To a degree, it was essential to remain flexible and adaptable, as events and situations may disrupt rigid plans, and it could work against its intent to plan in excessive detail in advance. However, in retrospective, our research is constrained by not delimiting the scope, which could have made us better utilize our given time. As mentioned in section 6.4, a better understanding, and knowledge of the domain could have reduced the risk of missing important aspects. By applying different research methods and approaches, the outcome could have turned out differently. First of all, conducting a qualitative research approach, we can not fully generalize our findings to the population at large. Our data sources consist of a small sample size, and we noticed huge differences between schools. With few people and schools studied, the overall representation is less accurate. However, a qualitative approach has a high level of details, which itself provides an in-depth understanding. Also, conducting interviews at schools provide insight in a domain which in general works similarly across the whole country, and has common work-practices.

There are some shortcomings to our interviews. There is no doubt that our research would benefit from a broader selection and amount of interview objects. Selecting more varied interviewees would have allowed the investigation of differences to a further extent within groups based on demographics and socio-economic factors such as gender, urban and rural, education levels, and age groups. To some extent, we also had a shortage to pursue in-depth information. Moreover, our subjects had no way of getting in touch with us, which could have provided us with additional insights. During the interviews, we could not provide a setting with little dis-

traction, being at a school with a substantial amount of noise. Our subjects were rushed from their work, and it was apparent that they had a lot on their schedule, which stressed the situation. It was not a comfortable setting for us either, given our limited experience with conducting interviews. We could also have conducted several types of interviews with the teachers, such as focus-group interviews, to have teachers interact and make discussion, as this could generate new insights. However, this was not done as we wanted to avoid disrupting many teachers simultaneously during school hours.

The *Principle of Multiple Interpretations* involves how there could be more than one interpretation or explanation for the data gathered, and to acknowledge that there always exist many different versions of a "story." Being two, we collaborated to write a review of our findings and to complement each other's comprehension. We strived to collect data from multiple sources, as explained in section 6.3. Therefore, it was necessary to pay several visits to the urban school, as it was the school where we could supply with additional information. There we collected input and viewpoints from several respondents as a supplement to triangulate and support the already collected data. It also helped us fill in the blanks on ambiguous information, to avoid assumptions and clear up misunderstandings. It is also a possibility of us missing important aspects by not recording the interviews, even though we were two conducting the interviews.

The most significant external factor limiting our research was the time-scope. Due to a short time-span after the field trip, we had to shorten our stay and the time for us to perform work and conduct our research, consequently making it a case study. Even though we did not complete a whole cycle of AR, with an extended stay, it could have been impractical to complete more than one cycle of the AR process nevertheless. Ideally, we would have had time for two trips to utilize the evaluation and reflection process. If we had time to perform an AR-study, this could have provided valuable information to us and the users. By performing a user-centered approach, we could have measured and observed reactions, as we would have increased users "look-and-feel" experience with a product, and we could have managed their expectations. Nevertheless, we would also have a stronger connection and affiliation with a product if we had a prototype and tested it.

Other challenges when researching developing countries consists of poor infrastructure, lack of public transportation, and long distances. MoBSE coordinated and arranged a two-day

trip for us to visit a rural school. Since we arrived at the school after a 6-hour drive, both the time-span of our interview and the amount of information we could gather was limited. Due to lack of time, and that visiting other rural schools were not feasible without help from MoBSE, we could not carry out more excursions than one.

6.6 Ethical considerations

Our research has considered and applied research ethics after the recommendations of (Oates, 2006, ch. 5) on *Participants and Research Ethics*. First, we want to highlight both the regularity and singularity of our research setting. Commencing the field trip, we acknowledged the possibility that some ethical dilemmas could arise during the fieldwork, especially since we were going to perform empirical research in a different culture than our own. Ryen (2004), as cited in Oates (2006), addresses how any guide to ethical conduct may not be universally applicable. Based on her own experience of conducting research in another culture, she uses the example of how an invitation to sign a formal document can in some cases, unintentionally highlight differences rather than building relationships in cross-cultural and oral societies.

The second characteristic is the organizational context of our fieldwork, which is highly related to the selection of research subjects. The election of pilot schools was not chosen by us, but by MoBSE, with our approval. Before getting access to the school, we paid a small visit, accompanied by a MoBSE, to introduce ourselves and let them know our agenda. Subsequently, when interviewing teachers, they were selected based on time and opportunity. We acknowledged that the subjects were subordinate employees asked to take part in our research, and are accustomed to doing as their superiors tell them. Thus, it was important for us to contemplate our participants' rights and keep in mind our responsibility, which we will elaborate in the next two sections.

6.6.1 Participants rights

It is essential for any researcher to keep in mind the participants' rights to; not participate, withdraw from the study, give informed consent, have anonymity and confidentiality (Oates, 2006, p. 56). Notably, in this case, performing research in an organizational environment, we are ob-

ligated to ensure that participants suffer no adverse consequences. Thus, we confirmed their anonymity and confidentiality, and all stakeholders and informants were aware of our study and its intent by participating and giving verbal consent. To enlighten our participants about our objectives, we presented ourselves and the topics we would like to address. The interviewees were told that we wanted their honest opinions, the time-span of the interview, and how the data would be used. We did not note any names or ask of unnecessary information such as age, as it would have no impact on our research. At one point, it was noted in our findings that a teacher was older than the rest of the staff, to reinforce the cumbersomeness of the tasks he performed. As we were interviewing teachers and disturbing them during work hours, we found it important to make no unnecessary intrusion. As previously mentioned, the research subjects were interviewed based on time and opportunity. To minimize occupying individuals, we paid several small visits and wanted to interview different teachers. Accordingly, we did not ask any question without significant importance or relevance, except topics they might consider relevant or felt passionate about explaining. Some limitations concerning participants rights is that we could not specify all topics in advance, a hindrance to participants being fully informed when giving consent. It occurred that topics came up, which had to be covered during interactions with informants. Still, we did not experience resistance or dispute regarding any of the topics that occurred. At last, we want to emphasize that we did not experience any ethical difficulties during our research.

6.6.2 Data considerations

Since we did not make any audio recording, our data collection consisted of observation and interview notes, documents, and pictures. During our field trip, the data was stored locally on computers and a dedicated memory stick. When we arrived back in Norway, the information was uploaded to a cloud service for storage and easy access. As we avoided sensitive information in our notes, no extra measure was taken to secure this information. A lot of the documents reviewed stored personal information about pupils and teachers. Therefore, the pictures used in this thesis have been censored of sensitive information. We also tried to our best effort to censor the name of the school, so reading this thesis would not reveal our source of information to more easily identify teachers. The schools visited is still known among the stakeholders;

thus, our effort has been focused on avoiding the identification of individuals. We are aware that some stakeholders could make a guess or know the persons involved, which could be a possible violation of confidentiality. However, less specification or details might lead to a lesser understanding of the case, so we have tried to make our subjects anonymous to the degree we feel is appropriate without negatively impacting insight in the case.

Chapter 7

Empirical findings

The empirical findings of this thesis will highlight the current information utilization and dissemination at the school level in the Gambia. It will present different registers and forms currently used at schools with a focus on the collection of data and information flow and further management of this information. One of the focus areas in this project is how to make the data collection user-friendly and beneficial for both teachers and the administration, with the main workflows being attendance registration and e-registers.

The empirical findings presented in this chapter will provide a clearer picture of the daily workload of the teachers both in content and extent. Additionally, the focus will be on another vital aspect regarding environmental factors, which in many ways directly affects their daily routines at work and how the teachers carry out their tasks and the extent of the challenges they face.

7.1 Part I - Workshop

The three employees from the EMIS team at MoBSE participated in the DHIS2 workshop to learn, build, and customize a new information system. All of them had technical backgrounds and education and prior experience within information systems. However, the workshop was the first time the team was in charge of building and customizing a software system themselves. Previously, they have worked with packaged and complete solutions that cannot be customized.

Their prior knowledge of DHIS2 was that colleagues in the health sector in The Gambia is currently using it. By practicing on the DHIS2 academy online, they had already become familiar to some of the functionalities the system presented. Their expectations for the workshop was to get an overview of the whole system, and all of its possibilities. For the system itself, they expected it to be fully scalable, adaptable, and be adequately flexible for their needs. Their first impression of the system was that it seemed complete and holistic, ranging from design to functionality. They also found it accessible, user-friendly, and liked how everything was just a few clicks away. The only hick up with the system was a lack of support when using Internet Explorer, as some functionalities did not work, and that there was no scroll bar.

> *"Demand for data is always high from international partners, local partners; it is never easy."*
>
> *- Member of the EMIS team*

7.1.1 Training

Amidst all of the positives from the training, there were also some issues that arose. The most common problem during the workshop was the pace of the training and the demonstration. The workshop was the teams first encounter with DHIS2. Thus it was essential to give the team a sufficient understanding of the system, causing the workshop to cover many topics in a short time-span. Being only three weeks long, they experienced parts of the program a bit rushed. The team did not feel like they had the required time to digest what they learned each day, quickly forgetting essential details. There is a lot of new terms and best-practices related explicitly to DHIS2, which could be instantly hard to grasp. Then they would have to figure it out at a later

point of time. The team feels that they could, alongside the practical tasks, have benefited from more explanations on what they were doing, and why.

One challenge was the team's computer performance, which actively prevented the team from keeping up during demonstrations. Two of the team members had old and ineffective computers which froze and was slow upon loading, refreshing, and opening web pages. The third member had a reasonably capable machine, as it was a slightly newer model with higher performance. Being sometimes unable to follow the demonstrations practically, the team temporarily solved this by solely paying attention and waiting to catch up at a later point of time. When they asked about the biggest bottlenecks in the course of the workshop, they mentioned hardware as a factor. They would without a doubt benefit from more powerful computers and agreed upon the benefits of either buying new or loaning computers, as well as having the training videotaped so that they could watch it later at their own pace.

Although there were some concerns, they were primarily satisfied with the training. They underlined that the workshop covered most of the topics they were curious about on beforehand for them to get a thorough understanding of the software. Likewise, did the possibility to ask questions during the training and that the representatives from HISP West and Central Africa aspired to provide immediate answers and explanations to their questions.

7.1.2 DHIS2

The EMIS team had much positive feedback on using the DHIS2. The workshop resulted in a broader understanding and practical experience in using the system. Following their expectations, they believe that the system is fittingly flexible and customizable to their needs. Digitalizing the system will extensively reduce the amount of paperwork and distribute the workload as it allocates the data collection. Hopefully, this could reduce data errors. When collecting the form, quality checking the forms has been a time-consuming effort. Challenges with paper forms could from both sides include misinterpretation, both in regards to handwriting and input errors.

Since the data is collected streamlined the way to report the data on paper has been cumbersome. By what they have learned during the training, they can use flat forms, generate tables by queries, and get a more customizable report.

Still, the team addresses that challenges could arise at a later stage of the implementation. The workshop has shown a lot of the possibilities DHIS2 offers. Still, there remain to practically test and implement the functionalities in a desired future solution. They must, therefore, take into account the possibility of some functionalities not being achievable.

Table 7.1: Summary of feedback

Benefits and strengths	**Challenges and weaknesses**
Learn through workshop	Little prior knowledge
Online Academy to support learning	Hardware issues
Covers many topics in a short time-span	Training felt rushed
Immediate feedback	Usability issues

7.2 Part II - Schools

7.2.1 Administration and management

Urban: The communication at the urban school mostly follows the administrative hierarchy. The schools have no regular staff meetings for all staff members. If the headmaster has a matter to discuss, she first talks to the deputy headmaster. Later she gathers all senior teachers, before addressing the rest of the staff consisting of junior teachers and two extra teachers. There is one senior teacher responsible for each grade, working together with a junior teacher. Therefore, the senior teacher is the one bringing a problem to the office on behalf of the junior teachers.

> *"I cannot discuss matters with everyone at the same time. First, I notify and inform the administration and senior teachers in advance and discuss matters to get several viewpoints before bringing it up to everyone."*
>
> *-Headmaster at urban school*

"Teachers share experiences. In a meeting, we can exchange ideas, for example, if the agenda is about the improvement of the school."

"It could be twice in a month, it just sometimes happens. Especially if there is an issue."

-Teachers at urban school

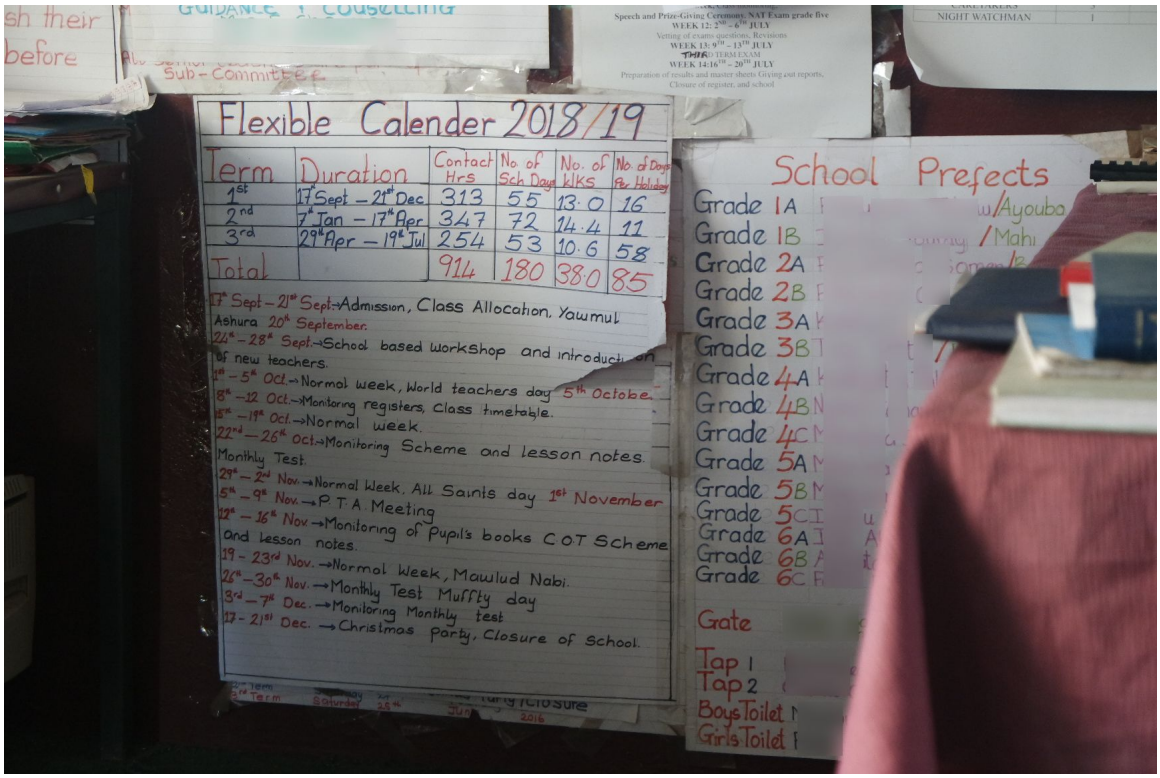


Figure 7.1: Headmaster office at urban school

Rural: The rural school has a different management approach being a smaller school with fewer staff members. The school is affected by region 6 having a different structural system. The headmaster and deputy headmaster are considered the administration, similar to the urban school. The rural school works closely with both the cluster monitor and PTA to deliver some of the paper-based information. The urban school also mentioned the existence of the cluster monitor and PTA, but their degree of importance in the data collection remain unnoticed Assumable are all schools concerned with them to some degree. In contrast, has the school a flat management structure as the teachers talk directly to the headmaster if they have a matter to discuss.

7.2.2 The school as a data supplier

Urban: At the urban school, the workload for the teachers mostly consists of collecting and writing information on paper. This information includes making a schedule for two weeks at a time, registering attendance in a register two times a day, information about test and exam results, keep statistics on pupil performance to fill out a report card.

> *"There should be at least two teachers to handle a class as a measure for quality, to share responsibility. I must stay two, three hours after school hours to get work done. The workload would be easier with two teachers. One could mark the children's books, and the other teacher could prepare the class."*
>
> *-Teacher at urban school*

> *"Data is not always accurate. To help the school with this, we will be very happy and satisfied."*
>
> *- Headmaster at urban school*

> *"We try our best with what we have."*
>
> *- Deputy headmaster at urban school*

At the urban school, some of the teachers expressed more interest in the pilot, as they have previously initiated and worked on inserting pupil data and information into Excel-documents. That was a preferable method by some of the teachers, performed individually. The digitalized information is, therefore, not collected anywhere. In general, the teachers expressed that they would be grateful for a digital system.

> *"Data storage on computers would be easier to manage. Then you can fill in the information once, and be done."*
>
> *- Teacher at urban school*

The teachers feel that most of the registrations are time-consuming because of the total workload is too extensive. It will be less of a burden with a computerized system. As they have specific ways of performing their work already, a computerized system could represent the same workflow, so they will know what to do and what to fill in. Since they already must do most of the work on paper, they feel that to fill out the same information on a computer will not make a huge difference. As a lot of the information they fill in does not change, a computerized system could decrease workload as they would avoid entering and repeating the same information manually.

> *"The responsibility is less since the effort is less."*
> *- Teacher at urban school*

Rural: All of the data supplies at the rural school consists of paperwork. A form for monthly attendance is filled out and delivered once a month to the regional office. The form is done personally by the headmaster. They feel like this solution works fine; however, they expressed some concern regarding the handwriting and whether it is correctly read. The headmaster also mentioned that if teachers are absent, he must deliver the form himself, something he does not really have time to do. Teacher attendance and Teacher Performance Monitoring Record (TPMR) are entered weekly and collected by the cluster monitor, which then delivers all the forms from the cluster to the regional office. At the end of each term, the teacher attendance is entered on a computer for MoBSE to collect. The TPMR is only obtained by the regional office, though this is something that MoBSE also would like to receive in the future. The ASC is filled out by the headmaster in collaboration with the teachers. This scheme has to be verified by the cluster monitor and the regional office before being delivered to MoBSE.

7.2.3 The school as a user of data

Data that could be useful at school level and unload the teachers' work are pupil performances such as grades and attendance. When there are exams and tests, the pupils get feedback on a report card. For the teachers to provide this information, the teachers personally store all results throughout the year so that they can provide overall scores through Report Forms. In addition to

teachers storing this information, the headmaster also wants to receive information about the pupil's grades. None of the schools visited expressed any knowledge of the yearbook, which is available online.

Urban: One of the senior teachers expressed a desire to see the progression and development of the school. She mentions that there is a great deal of competition between schools. After a while, she clarifies competition such as drawing and singing. Still, she was in favor of comparing their performance in contrast to other schools.

> *"How the school is moving forward, its progress, or if it is decreasing."*
> *- Teacher at urban school*

> *"It would be helpful to have a digital overview of student attendance to see if there is some common denominator to those who stop coming to school."*
> *-Teacher at urban school*

Rural: When the rural school delivers the ASC, they receive a School Report in return with information from the previous year collection of the ASC. They are pleased to receive information in return, but state that they could benefit from having the information delivered earlier since the information is outdated.

7.3 Part III - Information at school level

This section will present the information about workflows and registers encountered at both the urban and rural school. At the school, there is a lot of routine work, which highlights the work day for teachers and the administration. As they are meant to perform work, all the various registers, books, documents, and reports have different purposes. Some practices are based on demands from MoBSE, while others could be part of the internal school or teacher practices. During the school visits, it was not clear if all practices and workflows were discovered, as differences between the schools were not always followed up. The sender and recipient of information is illustrated in figure 7.2 and 7.3. The cluster monitor at the district level exist, but

their purpose and part of the workflow is diffuse. Therefore, in most cases, information practices that remain in schools, or are ultimately delivered to the regional or central level at MoBSE are considered. Additionally, the registers and sheets are limited to what the schools presented during the visits. Therefore, undiscovered important similarities and differences between the schools might exist.

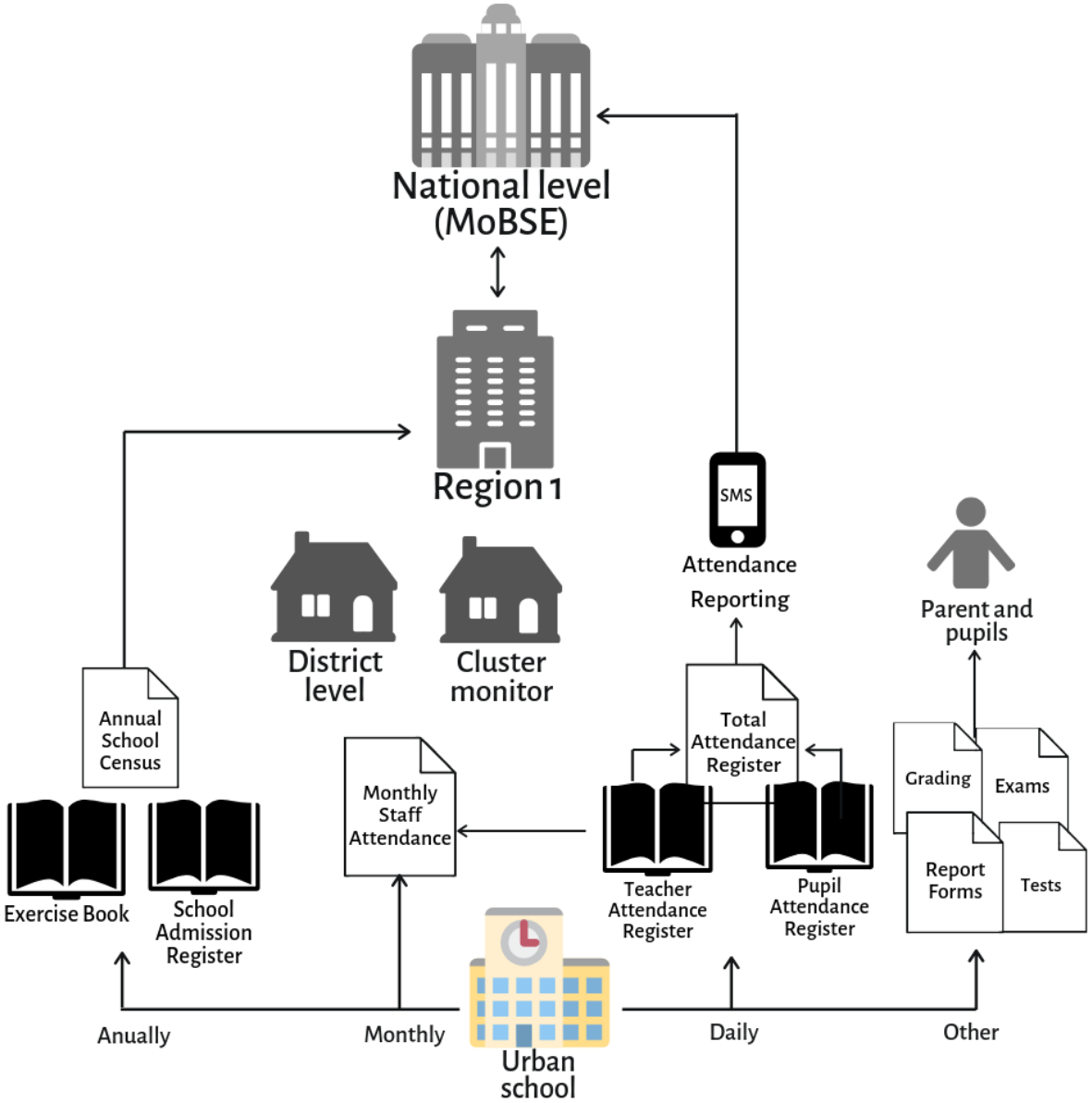


Figure 7.2: Information flow at urban school

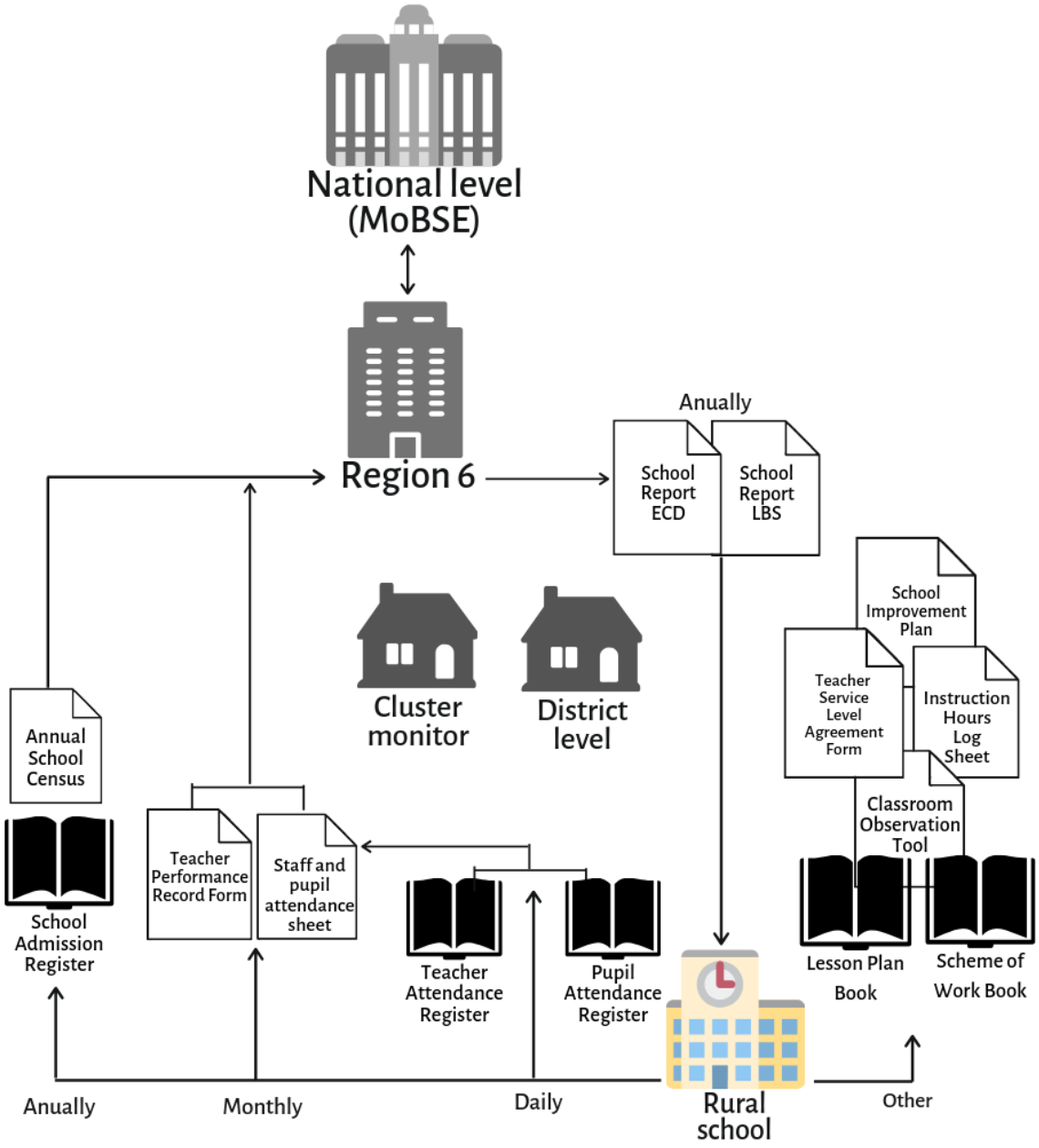


Figure 7.3: Information flow at rural school

7.3.1 Annually

The main workflow that occur annually are the ASC, as mentioned in chapter 5. It is the most important matter for MoBSE to digitalize.

Annual School Census

The ASC provides information about the school and environment, as pupils, teachers, supplies, infrastructure, and facilities. As this form is filled in by all schools in the country, both the urban school and rural school use it.

Urban: The information is filled in by the DHM and takes approximately one week to finish. She thinks it is cumbersome to fill out. After filling out the form, the school prints a copy before forwarding the original document to the Ministry. This is a safety procedure to ensure no loss of information in case the original document gets lost. If that were to happen, the school would have a backup and could forward the copy.

> *"It takes approximately one week to finish. We take a copy of it, before we send it in. Then we do not loose the information if the document gets lost."*
> *-Deputy headmaster*

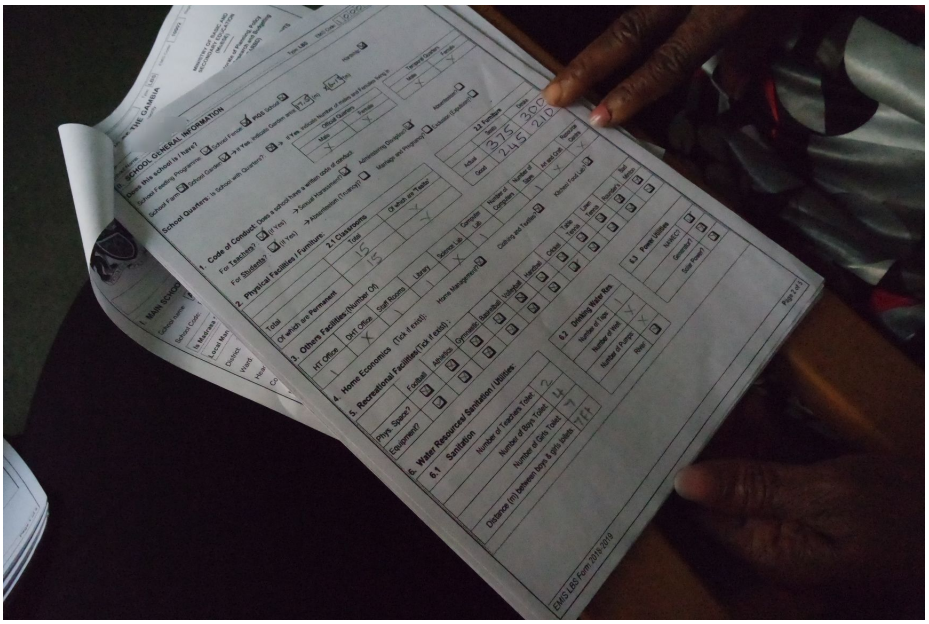


Figure 7.4: ASC at urban school

Rural: Since the rural school is both LBS and ECD, it has to deliver two ASC. When the rural school delivers the ASC, they are given a School Report in return that provides them with last

years information and comparative data for their district and region (see appendix A.4.2). It is unclear if the urban school receives this report.

School Admission Register

The book is provided by MoBSE to register the enrolled children at the schools and is used by both the urban and rural school. All pupils have an admission number, but the number is only unique in the specific school where the child is enrolled.

Urban: At the urban school, the teachers first put the children in the "Exercise Book." The School Admission Register is the second step to children being enrolled as pupils at the school. The School Admission Register was not up-to-date and was incomplete for the year 2018/2019 because of the total workload being too severe. Meanwhile, the information is stored in the Exercise Book and the Pupil Attendance Register to keep track of the children at the school. The School Admission Register was not up-to-date for previous years either. If a child is transferred, the parent or guardian gets a form to fill out, and the child is marked as "Transferred" in the Pupil's Attendance Register. The form is then brought to the new school. If a pupil drops out, the parent's can, if they want to, ask for and receive information about their child.

> *"Drop-outs rarely happens, so we do not have to face with such situations."*
> *- Teacher at urban school*

Rural: At the rural school, the teachers put the children directly into the School Admission Register. At the rural school which consists of both an ECD and an LBS, the pupils have the same admission number until they change school. If a pupil has attended the ECD, the pupil keeps their admission number when progressing to the LBS. If a pupil has not attended the ECD, the pupil gets an admission number when enrolling in the LBS.

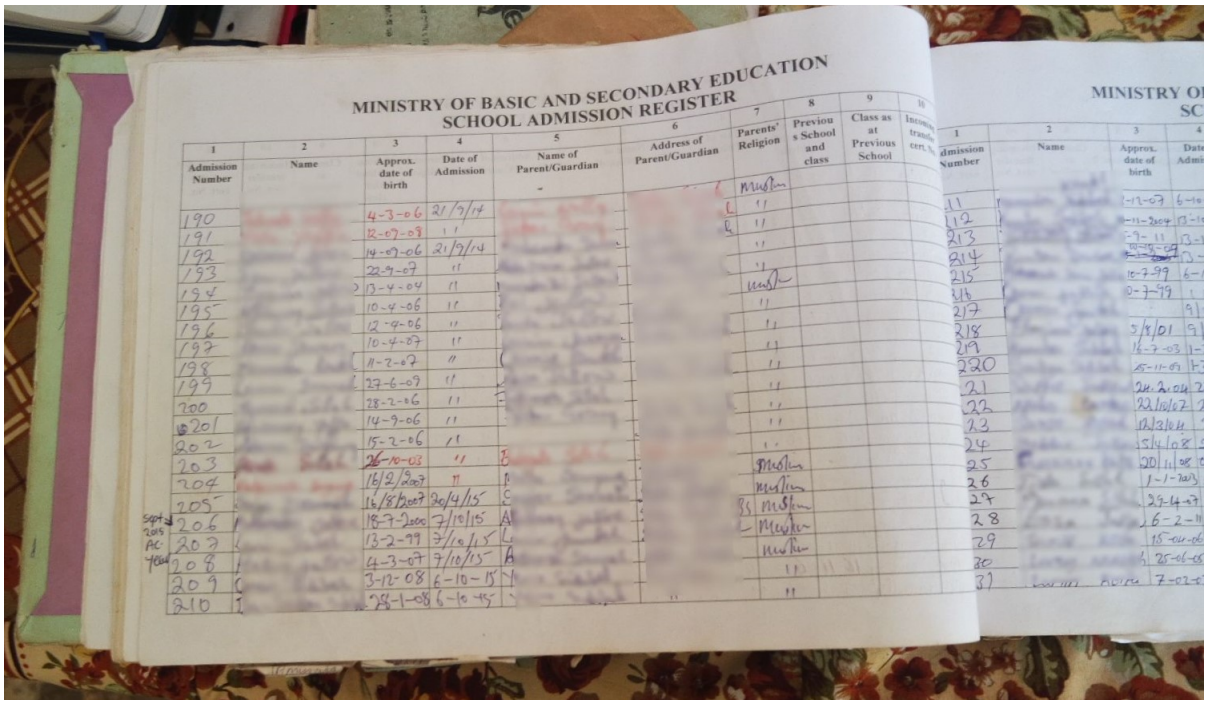


Figure 7.5: School Admission Register at rural school

Exercise Book

Urban: The Exercise Book is used at the urban school to register children who are going to be enrolled before they start in the 1st grade. The parents or the guardians bring the child's birth certificate to the school to register the child. They also and provide their contact information, as well as some additional information about the child, such as local language, religion, previous school. The school scans the Exercise book and hands the copy over to the teachers in charge of the 1st-grade pupils. The teachers then register them in the Pupil Attendance Register. Children that show up and start school are later registered in the School Admission Register and "checked off" in the Exercise Book. If a child does not show up when the school starts, the school attempts to make contact with the parent's to ask if the child still want to start school. The teacher can then omit the ones that perhaps changed school or did not enroll for the current term.

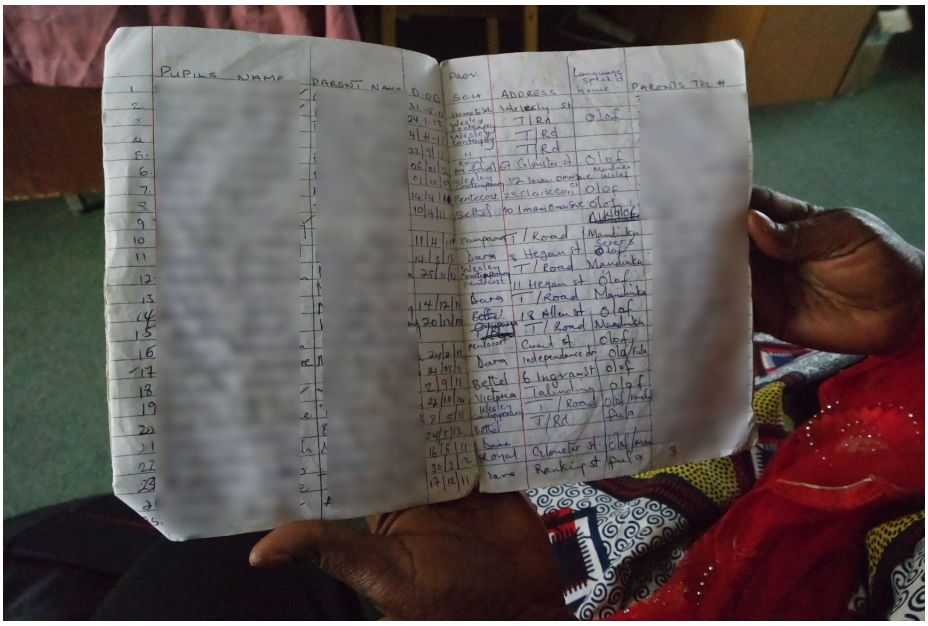


Figure 7.6: Exercise Book at rural school

The school aims to register as many children as possible before the school year begins. Therefore, they usually start to register children from the end of the spring term until the school year officially begins in September. When children are registered early, they can attend school during the summer. Teachers are in favor of parents enrolling their children as early as possible for two reasons:

1. The teachers may get an overview of the children, to map their knowledge and skills, such as language and other basic knowledge.

2. Provide children, with a lack of former knowledge, with some basic education to facilitate a more equal start for all children.

There could be significant differences in the children's knowledge and skills due to external factors such as kindergarten attendance, or no former schooling. There could also be other influences such as the parents, the environment, cognitive, and social skills. The teachers feel that mapping these factors during summer school makes the transition to school easier for every child that attends. Previously, on demand from the Ministry, the information in the Exercise Book was duplicated on the computer for the school to print out. The teachers felt this was too

time-consuming and they did not see the point of storing the information both on the computer and in the Exercise Book, so they went back to only using the book.

7.3.2 Daily

Daily workload for teachers are mostly connected to attendance registrations.

Pupil Attendance Register

Urban: The book is used at the urban school to register attendance. Since the book has a limit of 50 pupils, teachers at the urban school often operate with two books to maintain attendance because of large classes. The attendance is registered two times a day, first in the morning when pupils arrive, and secondly after lunch break. If a teacher is late, he will often manage to register pupil attendance before the hour ends. Since there are two teachers responsible for each grade, the other one can go and register attendance. If a teacher does not show, other teachers step in to do the registrations.

Figure 7.7: Pupil Attendance Register

"The time it takes to register attendance is approximately 15 minutes."
- Senior teacher at urban school

"It is not the most time-consuming job"
- Junior Teacher at urban school

After each registration, the teacher sums up the number of attendees. Pupils that are late are marked with an "L" in the register. This is used when the teachers fill out the report forms in regards to the pupil's conduct. At the end of each term, the teacher calculates the amount of "school days," and how many days each pupil have been attending school. This is used to calculate the average number of absentees in class. This information is only stored at the school level and is not collected by the Ministry, which is only concerned with daily attendance. The calculated information is only to provide an overview of the attendance rate at the school and to know if the pupils are punctual.

"Will be grateful for a system for attendance registration. It will take less time"
-Junior Teacher at urban school

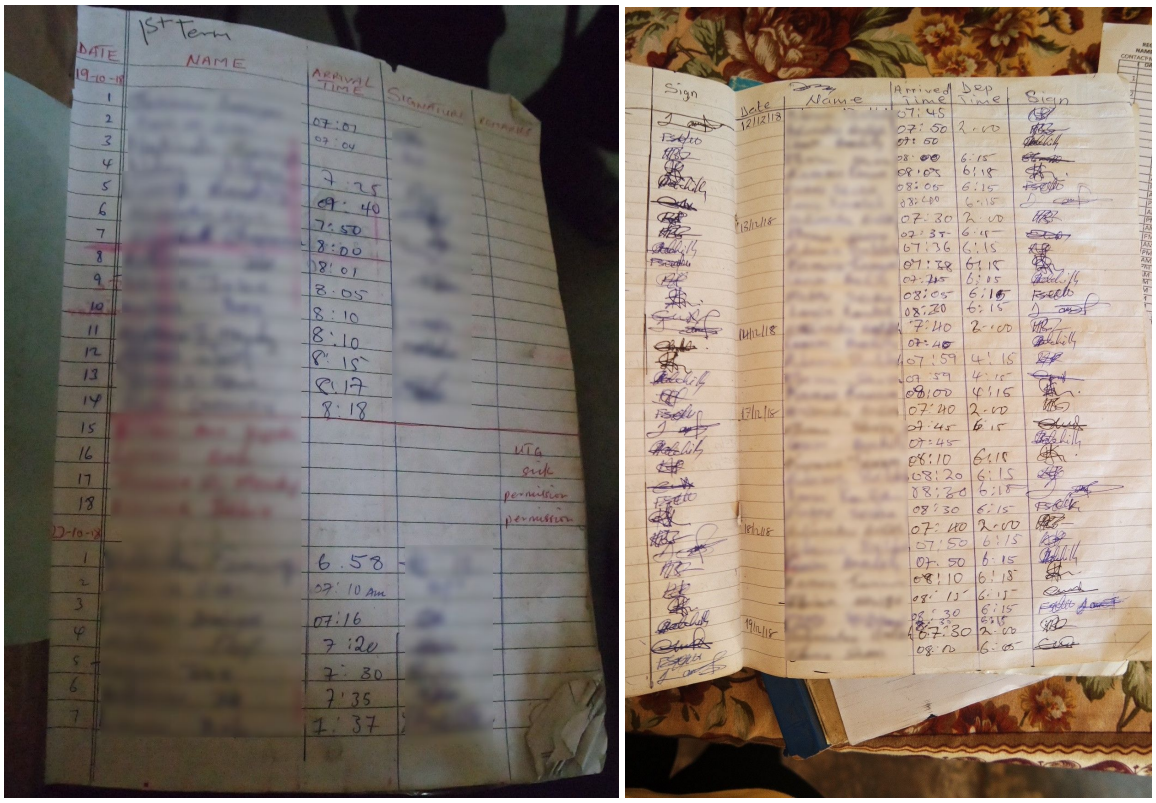
One of the senior teachers look over and double checks the attendance forms for all classes at the end of a term, before the headmaster authorizes them. Two separate teachers had two different formats of the book, but both books seem to handle and store the same information. The following pages show the attendance registration in its entirety, where the first page presents the information they input two times a day for all the weeks in a term, and the second page shows the form the teachers use to summarize attendance at the end of each term.

Teacher Attendance Register

This book is also called the Time Book. The book is used in both schools as a check-in for teachers to write their arrival time, and their routines are quite similar with some small differences.

Urban: The book is used to see if teachers were late work, and to see if they had valid permission. This information is further used in the Urban School to fill out the Total Attendance Register.

Rural: At the rural school, the Time Book is kept at the headmaster's office. The teachers are required to write down their department time when they leave work. There is no field for remarks because the headmaster knows if someone is absent with permission or not.



(a) Urban school (b) Rural school

Figure 7.8: Teacher Attendance Registration

Total Attendance Register

Urban: This book is used at the urban school to sum pupil's and teacher's attendance. The information is collected from the Pupil Attendance Register and the Teacher Attendance Register. It is one of the senior teacher's responsibility. If teachers show up late, they are either marked as "late for less than 30 minutes", or "late for more than 30 minutes". If teachers do not show up, the senior teacher will either register them as "absent with permission" or "absent without permission."

Rural: In the rural school, the same information is collected and written down on a form provided by the regional office, (see section 7.3.3 Monthly: Staff and Pupil Attendance Sheet)

"It is not the most time-consuming effort, but you know, I really do not have time to do it. But I must find time for it every day, because it is important."

- Senior teacher at urban school

Attendance Reporting (SMS)

Urban: At the urban school, the information about pupil and teacher attendance is supposed to be reported daily for data collection. The urban school has been supplied with a mobile phone for this purpose and is supposed to daily send an SMS to the Planning Department of the Ministry. SMS reporting is done by one of the senior teachers, using an old Samsung phone. Daily he has to enter the data elements, which he retrieves from the "Total Attendance Register."

"The teacher is an older man that has been using the same phone since he received it from the Ministry years ago. Still, he was very slow at using it. It was an old Samsung phone, not a smartphone, with an old telephone keypad with a tiny crack across the screen. To type in the query, he had to use the multi-tap approach that is the old, familiar, but conventional mobile phone text entry. While showing us how it was done, he had to correct several typing mistakes, which also took some time. He stated that there is no room for error."

- Excerpt from field diary, 12th of March 2019

When asked if he would be open to using a Smartphone for his work, he said that he prefers to do it the old way, but is open for another solution if it does not add any extra work. Learning this by himself was not something he was eager to do since he previously has not used a Smartphone. He said that a possible solution to learning it was if several people learned and knew how to use it, in case he was absent from work or if he cannot find time doing it one day. If other teachers also knew how to operate it and do the registration, the responsibility would not only be his, and he could also ask for help if needed.

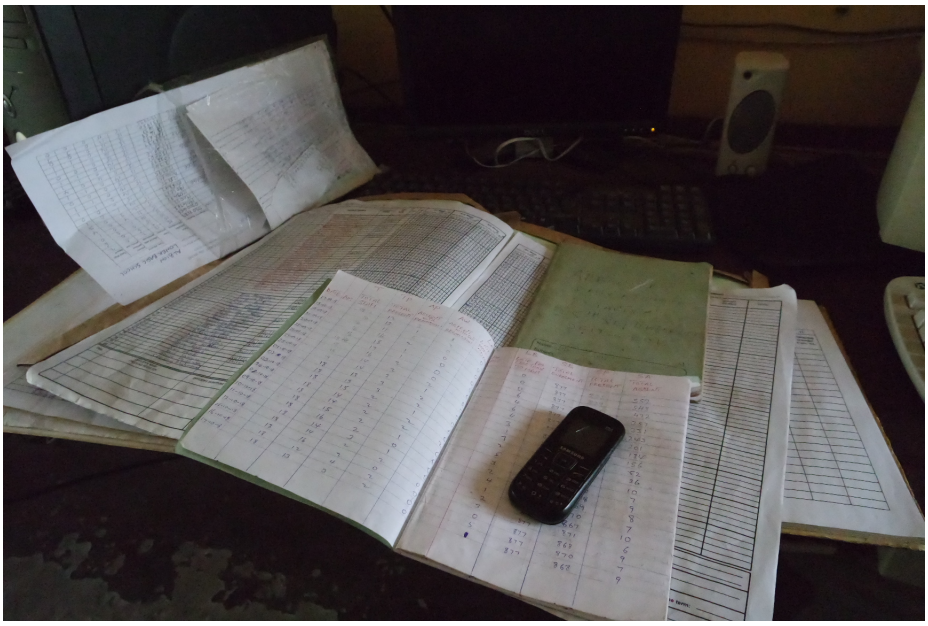


Figure 7.9: All books in use to provide the SMS solution

Rural: The rural school does not currently have a supplied phone, as there is no point because of lack of electricity.

7.3.3 Monthly

Monthly workflow encountered consist of summarizing daily attendance throughout the month. The practices are different at the urban and rural school, due to the urban school using the SMS solution and do not need to deliver the sheet, but fill it in nevertheless.

Monthly Staff Attendance

Urban: The Monthly Staff Attendance is a paper form filled out at the urban school as a summary of each staff member's attendance the previous month. It is only used for school level purposes.

Staff and Pupil Attendance Sheet

Rural: The rural school fill in the Staff and Pupil Attendance Sheet and delivers it to the regional office at the end of each month. The deliverance is done personally by the headmaster. The form has identical data elements as the urban schools' Total Attendance Register. It is filled out by the

headmaster, and information to fill it out is collected from the Teacher Attendance Register and the Pupil Attendance Register.

> *"It takes time to collect the pupil absence, but that it is not to bad since I already have the information from the other books."*
>
> *"I always deliver it on time, but once I lost the form, because there was a lot of alteration in the teacher staff. Then I had to rewrite and deliver the form, as it is important."*
>
> *- Headmaster at rural school*

7.3.4 Other

Some tasks that are related to terms are according to pupil performance and merits. These practices were only observed at the urban school, but assumable, similar practices exist in most schools. There was also observed one weekly routine at the rural school.

Teacher Performance Record Form

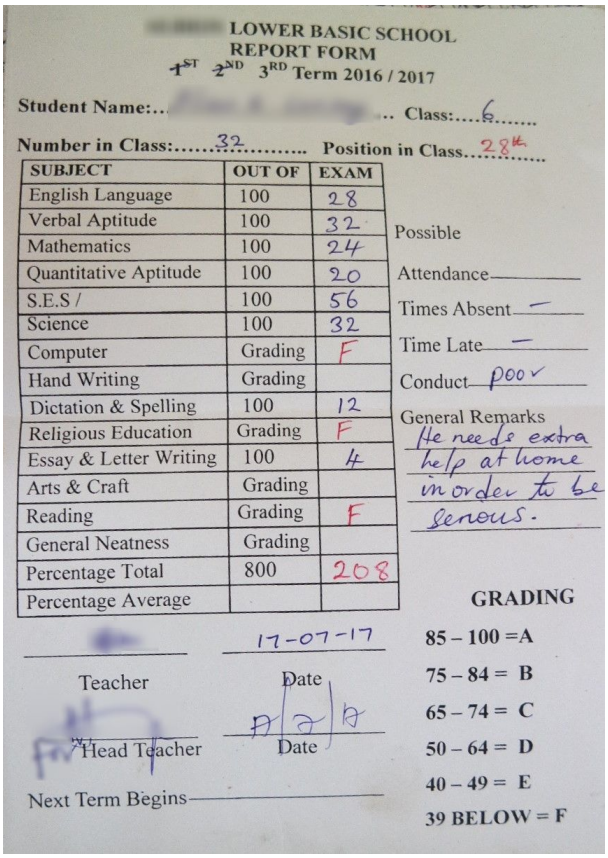
Rural: The TPRF was encountered in region 6, but MoBSE express it is not limited to it. It is a monitoring tool used by the regional office to assess whether the teachers are doing their jobs. The form consists of four main categories, which are: Attendance, planning, curriculum delivery, and assessment. Subsections of these include lesson plans developed, tests conducted, and lesson plans delivered. It also has the option to write down any remarks regarding any inconsistencies. The form is filled out weekly and collected and verified monthly by the cluster monitor, who then delivers it to the regional office. The regional office uses these data to create performance reviews of the teachers, which the school receives upon completion at the end of each term. The performance reviews consist of goals, achieved percentage, and the way forward. If a goal is not reached the way forward is used to describe how to achieve the goal. MoBSE is currently working on using the data to inform Human Resources Management, and want this as a part of the digitalized EMIS.

Report Forms

Urban: The report form is filled out by the teachers. It is the school administration who is managing the school's subject and how the grading should be performed. The report forms are therefore only used at school level and could be performed differently elsewhere due to other grading practices, different subjects, and forms. The teachers hand out the report cards to the pupil's parents during an open day.

"The report forms are time-consuming to fill out. We only get the exact number of forms according to the number of pupils, so there is no margin of error when filling out the form. Therefore, we draft everything in a notebook first."

-Teacher at urban school



LOWER BASIC SCHOOL
REPORT FORM
1ST 2ND 3RD Term 2016 / 2017

Student Name:... Class:....6.....

Number in Class:.....32..... Position in Class...28th.....

SUBJECT	OUT OF	EXAM
English Language	100	28
Verbal Aptitude	100	32
Mathematics	100	24
Quantitative Aptitude	100	20
S.E.S /	100	56
Science	100	32
Computer	Grading	F
Hand Writing	Grading	
Dictation & Spelling	100	12
Religious Education	Grading	F
Essay & Letter Writing	100	4
Arts & Craft	Grading	
Reading	Grading	F
General Neatness	Grading	
Percentage Total	800	208
Percentage Average		

Possible
Attendance
Times Absent —
Time Late —
Conduct poor
General Remarks
He needs extra help at home in order to be serious.

GRADING
85 – 100 =A
75 – 84 = B
65 – 74 = C
50 – 64 = D
40 – 49 = E
39 BELOW = F

17-07-17
Teacher Date
Head Teacher Date
Next Term Begins

Figure 7.10: A report form at urban school

"We use a week or more to fill out everything. Then we copy the report forms, that

is handed out to the parents. The school keeps the original form. It is stored at the headmaster's office."

-Teacher at urban school

Tests, exams and grades

Urban: A few teachers use computers to write tests and to store test results and grades. For exams, the grades are registered either directly into a computer or on paper by a teacher. This process depends on preferences and abilities. For the teachers not using computers, a colleague must type in the grades for them. A list of the grades is hung up publicly on the wall. Regular information measured at school level, such as tests, exams, grades, and pupil's conduct/behavior, currently remain at the school level. Information about the pupil's performance in school to higher levels is only provided through national tests.

Chapter 8

Discussion

8.1 Transferring experience

For the sake of the discussion, this chapter will revisit the research questions.

RQ: *How transferable is DHIS2 to the education domain, and what challenges digitalization in The Gambia?*

The importance of education as an area of focus in development should not be underestimated, as it could generate both national and personal benefits. In the literature, the importance of education for economic growth and the development of a country has been examined. Transferring experience and building competence is an essential part of accomplishing long-term development goals. Utilizing ICT will not only generate local expertise, that could be applied in several ways. Aimed towards the development of a digitalized IS to use within education and schools, the effect reinforces itself accordingly. The literature confirms the importance of public services, grounded in good health and motivation to learn. It is highly connected with the freedom to pursue personal development and education. The use of DHIS2 within both domains certainly are part of a broader development agenda.

SQ1: *How is digitalization affected by the process and the environment?*

With the shift from health to education, there are several factors to consider for its success. The implementation should be less costly and decrease workload compared to creating a new

system. Due to its recent shift, there is a shortage of research and examples of successful implementations. In comparison, there is a lot of expertise within the health sector. Nevertheless, the value of transferring preexisting functionality and knowledge are beneficial for all parties involved. However, it is challenging to conduct any development without aid from HISP. As the domains are inherently different, it is crucial to take necessary steps to ensure the system is evolving to fit the new domain. It is not self-evident that what works within health can work for education. It is a sector that works differently at its end-points, in terms of people, purpose, and workflows. Still, the essence of its use, such as the workload and the means to perform these tasks remain strikingly similar. There are a lot of paper-based workflows and high demands of information, and it could be essential to address what is conditional for DHIS2 to perform in other localities.

8.1.1 FOSS, DHIS2 and EMIS

The history of HISP and the development of DHIS2 consists of several innovative modifications, some more significant than others. Growth has been evident over time, regarding geographical expansion in several countries and places with different needs, leading to new applications of use. Its adaptive approach embraces continuous learning and insight, and DHIS2 has for long practiced and learned the health domain. As the system attempts an implementation in the education domain, there is an underlying assumption of transfer-value between the domains. However, concerning the system, the DHIS2 is, in principle, FOSS. In general, FOSS transpired from OS development, which questions its transfer-value to EMIS. But the essence and the quality of FOSS is its distribution of software. Its openness symbolizes the possibility to transfer source code within contexts and uses. If there were nothing to reuse, FOSS would to some degree not exists.

History indicates it could be challenging to conduct FOSS development when users are not developers. DHIS2 being in the world of open source would, in theory, mean that anyone could have been a part of creating the EMIS system that The Gambia needs. Still, there are high thresholds preventing participation. It also questions why DHIS2, in principle, is considered FOSS. Concerning motivation in FOSS, there could be a strong element of self-interest, such as recognition both outside and within society. Concerning the importance of digitalizing and aiding

developing countries, there could be an interest to contribute, based on motivation. Still, the literature question if high participation rates mutually relate to high acceptance rates. Also, reciprocity has been an integral part of acceptance and affiliation within FOSS communities. Recollecting the social conventions and high thresholds of FOSS communities, it is not straightforward to participate in The Gambia either.

It would, to an extent, be possible for an independent programmer to offer some help with the system. However, several constraints make it less likely, nor expedient for anyone to contribute without having any correspondence to MoBSE or HISP. The DHIS2 also include technical and specific terminology and rule-sets that would be hard to grasp without having any previous knowledge of the DHIS2 itself. But DHIS2 offer strength in its foundation to perform user-centered approaches, to locally engage and support independent learning, while at the same time, listening to local needs. Implemented in several developing countries, HISP provides experience within the same contextual settings. MoBSE's choice of selecting DHIS2 was its history of previously successful implementations, and the possibility to customize. MoBSE was also familiar with its use within health in The Gambia. Other software providers were opted out to high price and maintenance dependencies. The data collection, analysis, and reporting needs from the MoBSE are facilitated through academies and workshops to support capacity building. In accordance with FOSS, the HISP community provides support and affiliation.

In the case of HISP, MoBSE will decide what to do with the platform. As they are on the demanding side of the data collection, they also decide what to digitalize. Time-constraints and altering demands and needs would prevent independent programmers from working efficiently with the system. Without MoBSE's involvement, it would be hard to determine and grasp the core of what data they consider essential and beneficial to gather. The implementation is, for the most part, the digitalizing of existing paper-based forms. Additionally, a lot of organizational information is unavailable on the Internet. Both the amount and type of information required is mainly available from MoBSE. At the same time, it is within an organizational context, not something that can be attended and worked on without authorization. Before the workshop, delays were encountered concerning funding and arrangements, both governmental and organizational. Meetings and arrangements had to be established for the HISP team to commence their project. This was no hindrance during the field trip, but it would have been considered

rude, and out of place, to research without the approval to do so. Another part is what was perceived as an interdependent arrangement between MoBSE and HISP to get the training started, as the training and workshop facilitates and aids MoBSE to learn the system. However, MoBSE does not directly contribute to the source code, and perhaps they are technically inclined to do so. This fact questions a lack of knowledge sharing and potential freedoms. In collaboration with HISP, MoBSE configures the system. To make it useful within their context, they need to request functionalities accordingly from developers that decide what is feasible.

Another aspect was that an underlying requirement in FOSS seemed to be that users could work as developers. In general, very few people from developing countries participate in FOSS. As Nafus (2011) state, its "openness" should, in theory, lead to a more even distribution. Both infrastructural conditions and education can be reasons for this, despite its apparent absence of underlying requirement and barriers, such as education. The Gambian school system offers a complexity that is hard to grasp without talking to someone from MoBSE and the schools. Insight into the school's structure priceless, as it would prove a significant challenge to commence implementation without people knowing the education domain. In this case, the schools are obligated data suppliers and the end-users of the system. They provide insight and expertise, but the teachers cannot directly request functionality or report bugs and flaws. They need guidance in formulating what they want. In reality, as the MoBSE and HISP teams adopt the system, they have to consider themselves a mediating interaction between the two entities. It certainly magnifies the risk of missing essential points, and therefore, it is necessary to perform proper requirements gathering.

8.1.2 IS in low-resource contexts

The emergence of ICT can flourish sustainable solutions suitable for many different purposes, but a critical aspect in the development of new systems is the lack of awareness of the costs of failure. It is a well-known fact that many projects in the IT industry are considered unsuccessful, and barely any study has come to conclude with over 30% success rate. Additionally, a significant amount of research state that ICT projects tend to fail in developing countries. There is also an increasing number of eGovernment projects in transitional economies. Heeks (2003) stated the importance of eGovernment success, as it could also act as an incentive for future projects.

The high failure rate would, in theory paint a bleak outlook on commencing projects in the developing world. However, it is vital to remember that there are different degrees of failure and that a failed project can still have achieved its IT-related goals. The fact remains that all ICT projects face their own set of challenges. The success rate will increase drastically with the awareness to avoid some of the most obvious pitfalls and classic mistakes. Considering underdevelopment and the restrictions this entails, the importance of resource utilization is increasingly essential. With the seven dimensions of the design-reality gap, the risk of failure increases if the underlying requirements in a system do not sufficiently match the current realities. Thus, later in the discussion, the conditional challenges for the implementation of a full-scale national EMIS in The Gambia will be addressed. Nevertheless, the ICT field provides an infinite number of possibilities to reduce and overcome these obstacles. Therefore, it is essential to address them to evade the cost of failing. Countries must understand what to overcome and what the consequences are. From the literature regarding ICT in developing countries, classic mistakes were classified into people, process, product, and technology. The main concern is the lack of local adaption and customization for specific contexts. Even though there are common denominators between The Gambia and other developing countries, it might be optimistic to believe that what worked before will work again.

8.1.3 Infrastructural challenges

As mentioned in Chapter 3, several infrastructural challenges are influencing the implementation of a new information system. As the implementation has just begun, this section will also focus on problems that may arise, and how the infrastructure may cause issues further along the process.

The most pressing challenge when scaling the system to the entire country is the power supply. In the 2017 edition of the AYB (MoBSE, PPARBD, 2017), only 36% of the LBS reported having electricity. The EMIS team stated during our visit that there is a plan in motion to provide all schools with power. However, there is no estimate on when this will be achieved, and it could happen anytime within the next 2-3 years. A lack of electricity prevents schools from using any electrical devices. It challenges the implementation and would require other solutions such as solar-driven charging. Not only does it affect data capture on mobile, but it also affects com-

puter and SMS solutions. In the rural Gambia, a lot of villages also lack electricity, that prevents other local charging possibilities. It would be futile for people to own phones, as it is impossible to charge them. A lack of power creates ripple effects that affect computer literacy in the country. As we performed no user-testing, there is no estimate to which extent training and facilitation is necessary for areas that lack electricity. Conclusively, it may be beneficial to consider these factors before initiating a national implementation.

8.1.4 Implementation challenges

The close cooperation between HISP and MoBSE can utilize the detection of new requirements, influence the system, and by conversating, minimize the effort of implementing them. This collaboration will give the stakeholders a fair chance to have a sustainable solution to an EMIS. Nevertheless, DHIS2 posed some challenges during the workshop, with no immediate solution.

First and foremost was the occurrence of different time intervals in education and health. In health, there is only a need to perform annual analysis for January to December. However, DHIS2 once needed to meet the need for an intersection between health and finance, which resulted in the static option "fiscal year." However, for schools, the academic year begins in autumn. In The Gambia, this is in most cases September. The school year has different term intervals from year to year because of external factors like rain season. To pre-define a school year, as done with the financial year, may cause problems in the future, and will likely not be a sustainable solution. It may suggest a need for dynamic and flexible periods, something the DHIS2 developers must consider.

Secondly, was how to structure the organization unit hierarchy, which is decided based on data flow from the highest level to the lowest level. As explained earlier, there are six regional offices across the country, and the regions are divided into districts. Some interventions are targeted at the district level, and the data analysis is presented on both region and district level. Therefore, the most logical and static structure would be to include the district. However, in the current solution, the ASC is first verified by the cluster monitors, then the regional offices, and ultimately MoBSE. Clusters can include schools from several districts, and its structure frequently changes. To embed clusters would possibly not be appropriate in a system, as the setup in DHIS2 cannot be changed without further ado. However, its part in the current data collection

process may pose a challenge.

During the workshop, a lot of the examples and functionalities were highly related and tailored to the health sector. It occasionally caused delays and confusion, that required a thorough explanation. In some cases, matters had to be explored in detail, as it was challenging to find a similar area of application. Another example was map icons consisting of hospitals. However, considering this as a bonus feature, it is not a big problem, nor a high priority to implement. Despite the domain differences, many of the reporting situations and data elements have similarities, thus requiring the same functionality. Some examples are doctors and patients versus teachers and students, and medical results resembling grades. The reporting in both sectors consists of forms to fill out, calculations, and doing a lot of repetitive work as much is routine work done on a timely basis. Not only does the experience and knowledge from the health sector provide value to the new system, but it builds an expectation that the system will work. The number of successful cases, and its praise received from the health sector in many countries, including The Gambia, could drastically erase failure as a possibility.

It is near impossible to predict and avoid such obstacles altogether. With sufficient requirement analysis and thoughtful planning between the HISP and EMIS team, these challenges will likely be resolved during the early stages of the implementation.

8.2 Establishing requirements

SQ2: *What challenges the collection of requirements?*

Recalling the definition from (Dick et al., 2017, p. 8) on requirements engineering:

> "the subset of systems engineering concerned with discovering, developing, tracing, analyzing, qualifying, communicating and managing requirements that define the system at successive levels of abstraction."

It is not without reason requirement engineering is seen as one of the most important aspects of a project. Not only is it the basis that a project is built on, but a lack of requirements or ambiguous requirements can have fatal consequences. For this thesis, the requirement elicita-

tion from the end-users proved to be challenging from the beginning. The scope was extensive, as it included environmental factors, workflows, and registers at the school, in addition to the system itself which has limitless options. Because of demand from MoBSE, the schools are obligated data suppliers. It could be important to address internal data and information needs within the schools to establish the various use cases of the data, as well as what they would like to access. The scope may have been too broad for the time given, leading to insufficiency at some parts of the scope. The software requirements were most affected by this.

The teachers currently have an extensive workload when it comes to reporting and gathering data. Some work is done on demand from MoBSE, while other work is done on their own initiative with variations amongst the schools. To digitalize and implement familiar processes and routine work, may cause less negativity and opposing from teachers, and the transition from paper to a computer may prove less challenging. As a lot of the workflow will remain the same, it will not pose huge alterations for teachers. For a national implementation, it could be important to continue mapping internal school workload and workflows, to avoid the collection and analysis of unnecessary information and have a universal solution to fit all schools.

The lack of prototyping and user-testing challenged the requirement elicitation, especially when interviewing less computer literate subjects. In the world of FOSS, it is not uncommon that the users of the software are also programmers. With this form of participatory development, it is unnecessary to ask for user requirements, as the feedback prevails itself through feature requests, bug reports, and patches. Teachers do not automatically provide the requirements, but it could be crucial to have their views to enhance the sustainability of the data collection. A prototype would have utilized the users better as it would have provided them with a better understanding of the possibilities, given a more precise view of their computing capabilities, and to test the design. To some degree, their clear idea of requirements can be questioned. Most of the interviewees were solely positive and optimistic about digitalizing everything, and stop doing any more paperwork. Whether this was caused by lack of experience doing computer work or something else is unclear; however, all of the subjects were in unison and had nothing negative to say. When asked if anything may be more work or there would be any obstacles the answer was always no. There is no doubt that a digital system is more efficient with performing calculations and creating charts. However, some processes, like registering student attendance

on a tablet rather than on paper, would probably not take much less time in a classroom situation. What amount of requirements collected can be considered real requirements is something to question. As figure 2.1 suggests, collecting data from end-users would, to a more considerable extent, improve the extraction of them. Still, there is uncertainty to what extent this can be considered successful when looking at some of the pitfalls of involving end-users.

8.2.1 Expectations management

Considering the workload at the urban school, the teachers expressed that to digitalize everything would significantly reduce the amount of time required. However, questions were asked to make the teachers reflect on how digitalizing would reduce workload and time taken. An unrealistic optimism towards digitalizing all school routines could be counterproductive. One thing is to adapt to new technology, and another aspect is to implement it in their everyday work routines. A teacher expressed that she would be grateful for a system for attendance registration because *"it would take less time"*. When asked about downfalls and to what extent it would reduce the time taken, she hesitated, came off unsure and answered that she would only be grateful. Although, it may not be time-expedient to register daily attendance directly on a tablet or mobile compared to paper registrations. Still, it may be beneficial to enter this information early, as it is used in multiple registers such as the Total Attendance Registers, Monthly Attendance Reporting, and SMS reporting.

Acknowledging the history of failure in ICT projects, their anticipation and expectations to the project may be considered overly positive. It is crucial to have realistic and feasible expectations for all stakeholders. To some extent, there should be a cycle of expectations management in the upcoming phases of the implementation, which could also increase the stakeholders' future collaboration. Considering the sense of skepticism regarding whether this project would actually be completed, and that the school would benefit from being a part of it, greater involvement from the pilot schools could prove beneficial. Previously, the school had been involved with another project where the kids would learn math on computer tablets. The school's experience was that the second the research was done, the tablets were removed, and they got "nothing" in return for helping. They trust this project to move forward, but at the same time wanted assurances that they would be provided with the necessary facilities to be a part of the

project.

8.3 Establishing information quality

SQ3: *What challenges a successful system implementation in regards to information quality?*

There is no doubt that irrelevant, untimely, and complex information would bring little value. More importantly, it may lead to poor decision making and improper resource allocation due to inaccurate or incomplete information. With the digitalization of EMIS, it is important to map some of the challenges that could be important to prevent, handle, and avoid for future implementations. Thus, IQ is reviewed as an important factor to determine a system's success. Regarding the intention of EMIS to strengthen informed decision making, the quality of information is presumably a critical concern. Information and data quality factors are highly related to the definition of EMIS of Wako (2003), which will be revisited for the discussion.

> "to collect, organize and report accurate, relevant and timely data for planning and decision-making purposes, and to promote the use of information for educational development."

Research further proves that IQ is highly context-dependent, and some attributes could be more or less important than others. To examine what IQ characteristics that are related to EMIS, we have reviewed some of the potential issues observed in The Gambia.

False information

As financial distribution between schools is highly related to the number of enrolled children, over-reporting of pupils occurs. It is acknowledged as one of the challenges regarding data collection and supervision of the schools. Over-reporting also occurs on facilities, painting a false picture of the state of the school. An old ASC at the rural school had reported a false number of school supplies, which also wrongly embellish its current state.

Outdated information

Data being current is one of the factors determining if it is quality information. The main issue discovered regarding outdated information could be concerning the time-intervals of the registers and forms. In the ASCs, the information could easily be outdated, especially in regards to staffing and pupils enrolled, as this information changes regularly. At the urban school, the School Admission Register is not up to date, and will not be so in the foreseen future. Meanwhile, the information gets stored in the "Exercise Book," and the teacher states there is simply no time to enter all students. A digital register would address this issue, as information could be entered in the system at the first stage of the enrollment process, and unload the need for duplicating the data in several registers. The teachers also state that they would be happy to update the information during the year.

Incomplete, redundant and ambiguous information

First and foremost, a lot of registers, books, and routines contained the same information. Also, the information provided from the forms should include all facts and be concise. The biggest issue regarding ambiguous information is with the ASC, as the information asked for is not clearly defined. For example, the data elements concerning seats, are divided into "good" and "actual." Defining a seat as "good" depends on individual perceptions and opinions. The schools also have to report, e.g., number of taps and wells, without defining their state. At the rural school, the only source of water is a well that currently is caved in. From the ASC, it appears that the school has drinking water available when, in reality, there is no water source on the property. At the rural school, there may be several duplicates regarding children enrolled, unbeknownst to the administration. The rural school consists of both an EBS and an LBS, which follow the same numbering system. If a child is enrolled in the EBS before attending the LBS, the child will keep its admission number from the EBS when progressing to the LBS, having the same admission number as a student enrolled directly into the LBS. There is no estimate of how many schools use this system, so it is unbeknownst whether this is a common standard or a deviation.

It will be essential to ensure user-friendliness and reduce the amount of cumbersome and redundant entries. Considering the SMS-reporting, doing the multi-tap approach on an old cel-

lular phone is very time-consuming compared to modern touchscreen keyboards. Implementing a solution that works as a smartphone application could be beneficial due to bigger screens. The SMS query seemed very cumbersome as it had a lot of code words, and had no room for error. Downtime of the system was frequent due to input errors, and the data provided from the SMS-solution is not currently being used for anything. Also, as some entries might not be time-expedient to digitalize, it can be utilized by data serving several purposes to ensure usefulness of the data collected. With data already in the system, it could later be beneficial to explore new applications and area of use.

Inconsistent information

Information inconsistencies have not posed a significant challenge yet, as all forms are manually validated and entered on a computer. However, the delivery between each step of the ASC is time-consuming, and the verification process gets increasingly more extensive the further up in the hierarchy. Hand-written forms are occasionally hard to interpret. The forms are perceived as complicated to understand by the schools, possibly due to the lack of guidelines on how to fill them out. As the forms contain a lot of information, the process of verifying them is expected to be quite challenging, but insight into that process is limited. There are, however, instances in the findings of inconsistent data that may impact the system unless acknowledged and prevented. Most notably is within the ASC, as there is no set standard on how to fill out. For the data elements consisting of the number of facilities, in cases were no such facilities existed, the entries varied from "null," blank space or "X." If the forms had spaces to tick, it could be challenging to see whether a field consisted of a check-mark or an X. Also, the grading system is decided at school levels and can consist of percentage achieved, a number grade, a letter grade or passed/failed. Although MoBSE does not currently collect pupil Report Forms, different grading systems may pose a challenge in the future.

Data and information quality can certainly be increased. The implementation of a digitalized reporting system in all likelihood make it easier to ensure IQ, as it provides a better overview of the data. It could make it easier to check whether the information is reliable and to prevent false information, which limits decision making and planning. Intentional errors and inaccurate data are definite hindrances for a system used for decision making and resource allocation.

Nevertheless, the data collection inhibits some robustness, as it is well established and takes place in all schools. Unless the data is completely wrong, it may still be helpful and partly functional.

MoBSE expressed wishes of a future national database for pupils in The Gambia, to track their progress. In The Gambia, traditional names are extremely common, and many pupils have the same name and spelling. Thus, it is difficult to make unique identifiers. At school level, this is solved by all new pupils getting an admission number, which act as their identifier. However, the admission number is not unique nationally and is only connected to the specific school. Since the tracking of individual students has not been done yet, this has not caused any problems. However, being on the future agenda, a solution should be considered before moving forward. To track individual students may not be beneficial for planning and decision-making purposes, but it could undoubtedly unload the teachers' work. Especially if connected to performance and grades, as it is an extensive part of teachers workload.

8.4 Summary

The strength of embracing HISP and DHIS2 within the education domain lies in adaptability as a highly configurable and customizable platform to a various range of use cases. DHIS2 is currently used within several settings and assembles data collection and analysis for different levels into one system. As it initially supports the health sector, it has several resemblances to the data collection in the education sector with all its hierarchies. One of the core strengths of DHIS2 is the support and continuous development the network provides, having an established network with communities and academies. The history of IS and FOSS entails constraints and conditions that could impact a successful implementation, but the challenges are not unique within its context. Other problems such as adequate bandwidth, computers, and hardware are essential, but also not unfamiliar aspects. There is no justification for saying that it will not work for EMIS. However, HISP must continue to gain insight when embracing the new domain, as it has within all localities. Some of the weaknesses and challenges DHIS2 pose is both the technical and domain competence to build such a system. The workshop allows an inexperienced team to familiarize and configure DHIS2, to subsequently operate and maintain the system. Still, this

requires careful planning and understanding of the building of information systems, and insight in how to best analyze data in a relevant and meaningful manner. A potential pitfall of the DHIS2 could be that the system is not adaptable enough to provide a rapid and flexible response to inadequate planning. It is also essential to see the big picture when deciding what to digitalize, to provide national guidelines, and to consider the end-users for a sustainable solution.

Chapter 9

Conclusion

There is, without a doubt, several challenges to consider for the implementation of IS in developing countries, and project failure even occurs in countries possessing many of the essential prerequisites and resources to succeed. However, the number of successful implementations in low-resource contexts leads to the belief that it may be beneficial to study projects regardless of their setting. This case may have distinct differences and challenges, which are in close relation to the educational domain, its low-resource context, or surrounding the implementation of DHIS2. Still, the indicators of project failure are regularly alike, regardless of the reason causing them. This case study has not explored all of the pitfalls and success factors involved in the implementation of a new digital system but aims to highlight the main challenges. The contributing causes for the challenges have been explored in regards to the context, to reflect on possible measures. Furthermore, the knowledge and lessons learned could indicate important caveats that may be beneficial for future projects. However, it is vital to consider both own and others' experiences and knowledge when intending to develop and make use of information systems, and a pragmatic approach is highly advised.

This thesis has aimed to further supply on the knowledge of the building blocks in information systems. It builds upon an interpretive case study that took place in The Gambia. EMIS in developing countries has not been implemented and explored to the same extent as HMIS. Still, there is a lot to gain from increasing the data gathering while making the data more useful and accessible. The initial plan was to conduct action research with the intent to do a design-cycle to utilize active user involvement. Hence, the thesis acknowledges a potential lack in the

gathering of real requirements, which could further have provided valuable insights. Thus, the importance to close the design-reality gap through requirement engineering and close user-involvement should not be undermined.

Since the implementation of EMIS at this point of time is in the early stages of the pilot phase, there is no grounding to predict the project's success or failure. Looking at the underlying conditions related to the success of IT projects, there is no reason to believe that there is a higher risk of a system being classified as a failure because of being developed in a developing country. It is, therefore, reasonable to make the general assumption that this project will face many of the same challenges as any other software development project.

Bibliography

Access Gambia (2019). History of The Gambia. Retrieved from: http://www.accessgambia.com/information/history.html, 07.05.2019.

Balaji, S. and Murugaiyan, M. S. (2012). Waterfall vs. v-model vs. agile: A comparative study on sdlc. *International Journal of Information Technology and Business Management*, 2(1):26–30.

Bergquist, M. and Ljungberg, J. (2010). The power of gifts: organizing social relationships in open source communities. *Information Systems Journal*, 11(4):305–320.

Bieg, D. (2014). Pmi's pulse of the profession: Requirements management—a core competency for project and program success. *PMI's Pulse of the Profession*, pages 1–20.

Braa, J., Heywood, A., and Sahay, S. (2012). Improving quality and use of data through data-use workshops: Zanzibar, united republic of tanzania. *Bulletin of the World Health Organization*, 90:379–384.

Braa, J., Monteiro, E., and Reinert, E. S. (1995). Technology transfer vs. technological learning: It-infrastructure and health care in developing countries. *Information Technology for Development*, 6(1):15–23.

Braa, J. and Sahay, S. (2013). The Process of developing the DHIS. Retrieved from: https://www.mn.uio.no/ifi/english/research/networks/hisp/hisp-history.html, 09.10.2018.

Bureau of Labor Statistics (2017). Labor force statistics from the current population survey. *United States Department of Labor*. Retrieved from: https://www.bls.gov/cps/cpsaat11.htm, 10.11.2018.

Central Intelligence Agency (2019). The Gambia in the World Factbook. Washington, DC. Retrieved from: https://www.cia.gov/library/publications/the-world-factbook/geos/ga.html.

Checkland, P. and Holwell, S. (1998). Action research: It's nature and validity. *Systemic practice and action research*, 11(1):9–21.

Delone, W. H. and McLean, E. R. (2003). The delone and mclean model of information systems success: A ten-year update. *Journal of Management Information Systems*, 19(4):9–30.

Delone, W. H. and Mclean, E. R. (2004). Measuring e-commerce success: Applying the delone & mclean information systems success model. *International Journal of electronic commerce*, 9(1):31–47.

DHIS2 (2016). DHIS 2 User Manual. Retrieved from: https://docs.dhis2.org/2.22/en/user/html/ch01.html, 25.10.2018.

DHIS2 (2018). About DHIS2. Retrieved from: https://www.dhis2.org/about, 25.10.2018.

Dick, J., Hull, E., and Jackson, K. (2017). *Requirements engineering*. Springer.

Fehrenbacher, D. D. and Helfert, M. (2012). Contextual factors influencing perceived importance and trade-offs of information quality. *CAIS*, 30:8.

Finley, K. (2017). Diversity in open source is even worse than in tech overall. *Wired*. Retrieved from: https://www.wired.com/2017/06/diversity-open-source-even-worse-tech-overall/, 10.11.2018.

Free Software Foundation (2004). FSF About. Retrieved from: https://www.fsf.org/about/, 07.09.2018.

Free Software Foundation (2018). What is free software? Retrieved from: https://www.gnu.org/philosophy/free-sw.html, 26.09.2018.

Gartner, I. (2019). Gartner says global it spending to reach $3.8 trillion in 2019. Retrieved from: https://www.gartner.com/en/newsroom/press-releases/

2019-01-28-gartner-says-global-it-spending-to-reach--3-8-trillio, 09.06.2019.

Ge, M. and Helfert, M. (2007). A review of information quality research - develop a research agenda.. *ICIQ*, pages 76–91.

Geiger, R. S. (2017). Summary analysis of the 2017 github open source survey. *CoRR*, abs/1706.02777. Retrieved from: http://arxiv.org/abs/1706.02777.

Ghosh, R. A., Glott, R., Krieger, B., and Robles, G. (2002). Free/libre and open source software: Survey and study.

Gould, J. D. and Lewis, C. (1985). Designing for usability: key principles and what designers think. *Communications of the ACM*, 28(3):300–311.

Gousios, G., Vasilescu, B., Serebrenik, A., and Zaidman, A. (2014). Lean ghtorrent: Github data on demand. *Proceedings of the 11th Working Conference on Mining Software Repositories*, (MSR 2014):384–387. Retrieved from: http://dx.doi.org/10.1145/2597073.2597126.

Heeks, R. (2002a). Failure, success and improvisation of information systems projects in developing countries. *Development Informatics Working Paper Series*.

Heeks, R. (2002b). Information systems and developing countries: Failure, success, and local improvisations. *The Information Society*, 18(2):101–112. Retrieved from: https://doi.org/10.1080/01972240290075039, 08.05.2019.

Heeks, R. (2003). Most e-government-for-development projects fail: How can risks be reduced? *Institute for Development Policy and Management, University of Manchester. iGovernment Working Paper Series*, 14. Retrieved from: unpan1.un.org/intradoc/groups/public/documents/NISPAcee/UNPAN015488.pdf, 20.05.2019.

Heeks, R. (2008). Ict4d 2.0: The next phase of applying ict for international development. *Computer*, 41(6):26–33.

Heeks, R. (2017). *Information and communication technology for development (ICT4D)*. Routledge.

Hippel, E. v. and Krogh, G. v. (2003). Open source software and the "private-collective" innovation model: Issues for organization science. *Organization science*, 14(2):209–223.

Hua, H. and Herstein, J. (2003). Education management information system (EMIS): Integrated data and information systems and their implications in educational management. *Proceedings of the annual conference of comparative and International Education Society*, page 26.

Human Rights Library: Gambia (1997). Constitution of the republic of the gambia, 1997. reprinted 2002. University of Minnesota. Retrieved from: `http://hrlibrary.umn.edu/research/gambia-constitution.pdf`, 07.04.2019.

Independent Evaluation Group (2012). Capturing technology for development: An evaluation of world bank group activities in information and communication technologies. *The Evaluation*, 1.

Klein, H. K. and Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS quarterly*, 23(1):67–94.

Kohn, D. (2017). What do the most successful open source projects have in common? Retrieved from: `https://www.linuxfoundation.org/blog/2017/08/successful-open-source-projects-common/`, 30.05.2019.

Kossi, E. K., Sæbø, J. I., Braa, J., Jalloh, M. M., and Manya, A. (2012). Developing decentralised health information systems in developing countries–cases from sierra leone and kenya. *The Journal of Community Informatics*, 9(2).

Krogh, G. V., Haefliger, S., Spaeth, S., and Wallin, M. W. (2012). Carrots and rainbows: Motivation and social practice in open source software development. *MIS Quarterly*, 36(2):649–676.

Lerner, J. and Tirole, J. (2005). The economics of technology sharing: Open source and beyond. *Journal of Economic Perspectives*, 19(2):99–120.

Lindenberg, S. (2001). Intrinsic motivation in a new light. *Kyklos*, 54(2-3):317–342.

Lufumpa, Loiuis, J. and Lakpa (2018). The Africa Infrastructure Development Index 2018. Retrieved from: https://www.icafrica.org/fileadmin/documents/Publications/Africa_Infrastructure_Development_Index_July_2018.pdf, 08.05.2019.

Mao, J.-Y., Vredenburg, K., Smith, P. W., and Carey, T. (2005). The state of user-centered design practice. *Communications of the ACM*, 48(3):105–109.

Marnewick, C. and Labuschagne, L. (2011). An investigation into the governance of information technology projects in south africa. *International Journal of Project Management*, 29(6):661–670.

Mauss, M. (2002). *The gift: The form and reason for exchange in archaic societies*. Routledge.

McConnell, S. (1996). *Rapid Development: Taming Wild Software Schedules*. Microsoft Press, Redmond, WA, USA., first edition.

McNab, A. L. and Ladd, D. A. (2014). Information quality: The importance of context and trade-offs. *Proceedings of the 47th Hawaii International Conference on System Sciences*.

Miskon, S., Bandara, W., and Fielt, E. (2015). Applying the principles of interpretive field research: An example of an is case study on shared services. *Proceedings of 4th International Conference on Research and Innovation in Information Systems*.

MoBSE (2018). Education Summary Statistics 2014-2018. Republic of The Gambia. Ministry of Basic and Secondary Education. Directorate of Planning, Policy Analysis, Research & Budaetina.

MoBSE, PPARBD (2017). Statistical Yearbook 2016/2017. Retrieved from: http://www.edugambia.gm/data-area/publications/year-book-2017/260-yearbook2017.html.

Monteiro, E., Østerlie, T., Rolland, K. H., and Røyrvik, E. (2004). Keeping it going: The everyday practices of open source software. *Norwegian University of Science and Technology (NTNU)*.

Nafus, D. (2011). 'patches don't have gender': What is not open in open source software. *New Media & Society*, 14(4):669–683. Retrieved from: https://doi.org/10.1177/1461444811422887.

Nelson, R. R. (2007). It project management: Infamous failures, classic mistakes, and best practices. *MIS Quarterly executive*, 6(2).

NIDC (2018). The Gambia: Issuance of identity documents. Retrieved from: https://www.nidc.dk/-/media/nidc/Dokumenter/Notatbibliotek/10122018-Gambia-The-Gambia-issuance-of-identity-documents.pdf?la=da\&hash=0A870CB362750E86461AB8CCA8FC24D474FB9EEF, 15.06.2019.

Oates, B. J. (2006). *Researching Information Systems and Computing*. Sage Publications Ltd.

Open Source Initiative (2007). The Open Source Definition. Retrieved from: https://opensource.org/osd, 26.09.2018.

Ozturk, I. (2001). The role of education in economic development: A theoretical perspective. *SSRN Electronic Journal*. Retrieved from: https://doi.org/10.2139/ssrn.1137541.

Powell, M. (2006). *Rethinking education management information systems: lessons from and options for less developed countries*, volume 6. InfoDev.

Preece, J., Sharp, H., and Rogers, Y. (2015). *Interaction Design: Beyond Human-Computer Interaction*. WILEY, fourth edition.

Programme, U. N. D. (2016). Human Development Report 2016. Retrieved from: http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf, 04.03.2019.

PURA (2017). PURA Annual Report and Financial Statement 2017. Retrieved from: http://www.pura.gm/wp-content/uploads/2019/04/Annual-Report_2017.pdf.pdf, 08.05.2019.

Raymond, E. S. (2001a). A Brief History of Hackerdom. In: *The Cathedral and the Bazaar. Musings on Linux and Open Source by an Accidental Revolutionary*. O'Reilly & Associates, Inc., Sebastopol, CA., revised edition.

Raymond, E. S. (2001b). *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*. O'Reilly & Associates, Inc., Sebastopol, CA., revised edition.

Reinert, E. S. (2007). How rich countries got rich – and why poor countries stay poor. *Public Affairs*.

Roberts, J. A., Hann, I.-H., and Slaughter, S. A. (2006). Understanding the motivations, participation, and performance of open source software developers: A longitudinal study of the apache projects. *Management science*, 52(7):984–999.

Roland, L. (2018). *Designing architectural patterns for distributed flexibility in health information systems*. PhD thesis, UiO.

Roland, L. K., Sanner, T. A., Sæbø, J. I., and Monteiro, E. (2017). P for platform. architectures of large-scale participatory design.

Rolland, K. H. and Monteiro, E. (2002). Balancing the local and the global in infrastructural information systems. *The information society*, 18(2):87–100.

Ryen, A. (2004). Ethical issues. *Qualitative research practice*, pages 230–247.

Sahay, S., Sæbø, J., and Braa, J. (2013). Scaling of his in a global context: Same, same, but different. *Information and Organization*, 23(4):294–323.

Schweik, C. and English, R. (2012). *Internet Success: A study of Open-Source Software Commons*. The MIT Press, first edition.

Sen, A. K. (2001). Development as freedom. *Oxford University Press*.

Smith, A. C. and Stewart, B. (2011). Organizational rituals: Features, functions and mechanisms. *International Journal of Management Reviews*, 13(2):113–133.

Sonnekus, R. and Labuschagne, L. (2004). Establishing the relationship between it project management maturity and it project success in a south african context.

Stair, R. and Reynolds, G. (2013). *Principles of Information Systems*. Cengage Learning, eleventh edition.

Standish Group International (2015). The chaos report. *United States of America*.

Susman, G. I. and Evered, R. D. (1978). An assessment of the scientific merits of action research. *Administrative Science Quarterly*, 23(4):582–603.

Terrell, J., Kofink, A., Middleton, J., Rainear, C., Murphy-Hill, E. R., Parnin, C., and Stallings, J. (2017). Gender differences and bias in open source: pull request acceptance of women versus men. *PeerJ Computer Science*, 3(4):e111. Retrieved from: https://doi.org/10.7717/peerj-cs.111.

The Linux Information Project (2004). GNU Definition. Retrieved from: http://www.linfo.org/gnu.html, 07.09.2018.

The Linux Information Project (2005). BSD license definition. Retrieved from: http://www.linfo.org/bsdlicense.html, 07.09.2018.

Tiwana, A. (2014). *Platform Ecosystems: Aligning Architecture, Governance, and Strategy*. Morgan Kaufmann, Waltham, MA.

Toussaint, P. J., Melby, L., Hellesø, R., and Brattheim, B. J. (2017). Does information quality matter? *CEUR Workshop Proceedings*, 2001.

UIS (2018). One in Five Children, Adolescents and Youth is Out of School. UNESCO Institute of Statistics, Fact Sheet No. 48.

UNESCO (2019). Kunta Kinteh Island and Related Sites. Retrieved from: https://whc.unesco.org/en/list/761, 07.05.2019.

UNICEF (2014). Water, sanitation and hygiene. Retrieved from: https://www.unicef.org/gambia/activities_701.html, 08.05.2019.

Vasilescu, B., Posnett, D., Ray, B., van den Brand, M. G., Serebrenik, A., Devanbu, P., and Filkov, V. (2015). Gender and tenure diversity in github teams. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, (CHI '15):3789–3798. Retrieved from: https://doi.org/10.1145/2702123.2702549.

Wako, T. N. (2003). *Education management information systems (EMIS): an overview*. NESIS/UNESCO.

Walsham, G. (1995). Interpretive case studies in is research: nature and method. *European Journal of Information Systems*, 4(2):74–81.

Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, 15(3):320–330.

World Bank Group (2017). The Gambia - Education Sector Public Expenditure Review - An Efficiency, Effectiveness, Equity, Adequacy, and Sustainability Analysis. *Washington, D.C.* Retrieved from: http://documents.worldbank.org/curated/en/301101509466067040/Gambia-The-Education-sector-public-expenditure-review-an-efficiency-effectiveness-equity-adequacy-and-sustainability-analysis.

Appendix A

Additional Information

A.1 Annually

A.1.1 Annual School Census

The next pages show the ASC from 2018/2019 for ECD and LBS.

REPUBLIC OF THE GAMBIA

Progress - Peace – Prosperity

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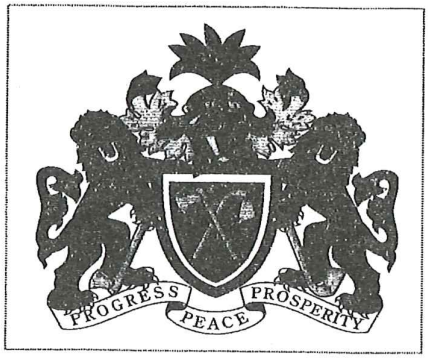


ANNUAL SCHOOL CENSUS

2018 / 2019

Basic Cycle School

MINISTRY OF BASIC ANDSECONDARY EDUCATION (MoBSE)

Directorate of Planning, Policy Analysis, Research and Budgeting (DPPARBD)

STATISTICS& EMIS & ICT UNITS

*To be filled by **functional schools** only.*
Carefully Read Accompanying Instructions Before Completing. Strictly Confidential.

I. MAIN SCHOOL DETAILS

School name: _____ School Type: **BCS**

School Code: _____ **Functioning Status?** Old (Known) ☐ New ☐ Closed ☐ Region: _____

Is Madrasa School? *(Tick if Yes)* ☐ → If **Yes**, Indicate **Type of Madrasa**: (M or N) _____ Year Established: _____

Local Management? Government ☐ Grant-Aided ☐ Private ☐ Class/Category: _____ *(0,A,B,C)*

District _____ Cluster Name: _____

Ward: _____ Settlement: _____

HeadTeacher: _____ Email: _____

Contact 1: _____ Contact 2: _____ Fax No: _____ PO Box: _____

Nearest **SSS**: _____ Distance to Nearest **SSS**: _____ (Km)

Data Collection verification & endorsement

Data Collected (Team Leader):

By: _____

Remarks: _____

_____

_____

_____

Date: ...../...../..... Signature: .....

Data Provided (at School level):

By: _____

Contact: _____

Stamp: _____

Signature: .....

Data Entry verification & validation

Data Entered by:

Remarks:

Data Verified by:

School Name: Type: **BCS** EMIS Code: Region:

II. SCHOOL GENERAL INFORMATION

Does this school is / have?

School Feeding Programme: ☐ School Fence: ☐ **PIQS** School: ☐ Hardship: ☐

School Farm ☐ School Garden ☐ → If **Yes**, indicate Garden area: ____ (m) X ____ (m)

School Quarters: Is School with Quarters?: ☐ → If **Yes**, indicate Number of males and Females living in :

Official Quarters	
Male	Female

Temporal Quarters	
Male	Female

1. Code of Conduct: Does a school have a written code of conduct:

For **Teachers**? : ☐ (If Yes) → Sexual Harassment? ☐ Administering Discipline? ☐ Absenteeism? ☐

For **Students**? : ☐ (If Yes) → Absenteeism (Truancy)? ☐ Marriage and Pregnancy? ☐ Exclusion (Expulsion)? ☐

2. Physical Facilities/ Furniture:

Important:Avoid double-counting: Refer to Morning organization of classes to report the share of classrooms/Furniture between LBS & UBS.

Lower Basic

LB - Classrooms

	Total	Of which are "Tesito"
Total		
Of which are **Permanent**		

LB - Furniture

	Seats	Desks
Actual		
Good		

Upper Basic

UB - Classrooms

	Total	Of which are "Tesito"
Total		
Of which are **Permanent**		

UB - Furniture

	Seats	Desks
Actual		
Good		

3. Others Facilities: (Number Of)

HT Office	DHT Office	Staff Rooms	Library	Science Lab	Computer Lab	Number of Computers	Number of Store	Art and Craft	Resource Centre

4. Home Economics(Tick if exist):

Home Management? ☐ Clothing and Textiles? ☐ Kitchen/ Food Lab? ☐

5. Recreational Facilities (Tick if exist) :

	Football	Athletics	Gymnastic	Basketball	Volleyball	Handball	Cricket	Table Tennis	Lawn Tennis	Rounder's	Bad Minton
Phys. Space?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

6. Water Resources/ Sanitation / Utilities:

6.1 Sanitation	
Number of Teachers Toilet:	
Number of Boys Toilet:	
Number of Girls Toilet:	
Distance (m) between boys & girls toilets:	

6.2 Drinking Water Res.	
Number of Taps:	
Number of Well:	
Number of Pumps:	
River:	☐

6.3 Power Utilities	
NAWEC?	☐
Generator?	☐
Solar Power?	☐

School Name: Type: **BCS** EMIS Code: Region:

III. CLASSES

III.1: Number of Classes by Shift & Grade

Shifts	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Total
Morning										
Afternoon										
Total										

III.2: Multi-Grade Classes

Is school operating multi-grade Classes? (Tick If Yes): ☐ If **Yes**, indicate Grades and Pupils involved in each multi-grade Class:

N°1		N°2		N°3		N°4		N°5		N°6	
Grades	Pupils	Grades	Pupils	Grades	Pupils	Grades	Pupils	Grades	Pupils	Grades	Pupils
Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐	
Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐	
Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐		Gr : ☐	
Total :		**Total :**		**Total :**		**Total :**		**Total :**		**Total :**	

IV. PUPILS TEXTBOOKS / TEACHERS GUIDES

IV.1: Number of Pupils Textbooks (Total Useable Copies) by Subjects & Grade

Subjects	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
English Language									
Maths									
Science									
SES									
Integrated Sciences									

IV.2: Number of Teachers Guides (Total Useable Copies) by Subjects & Grade

Subjects	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
English Language									
Maths									
Science									
SES									
Integrated Sciences									

School Name: Type: **BCS** EMIS Code: Region:

V.ENROLMENT

V.1.1: Lower Basic - Enrolment by Age, Grade & Gender

Age	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Under 7														
7														
8														
9														
10														
11														
12														
13														
14														
Over 14														
Total														

Total Enrolment (LBS) :

V.1.2: Upper Bassic - Enrolment by Age, Grade & Gender

Age	Grade 7		Grade 8		Grade 9		Total	
	M	F	M	F	M	F	M	F
Under 13								
13								
14								
15								
16								
17								
18								
Over 18								
Total								

Total Enrolment (UBS) :

V.2.1: Lower Basic - Repeaters by Grade & Gender

No of:	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Repeaters														

V.2.2: Upper Bassic - Repeaters by Grade & Gender

No of:	Grade 7		Grade 8		Grade 9		Total	
	M	F	M	F	M	F	M	F
Repeaters								

V.3: New Entrants toGrade 1

Total New Entrants to Grade 1→			Of which: new entrantswho have attended ECD		
M	F	Total	M	F	Total

School Name: Type: **BCS** EMIS Code: Region:

V. ENROLMENT *Cont'd*

V.4.1: Lower Basic - Enrolment by Shift, Grade & Gender

Shift	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Morning														
Afternoon														
Total														

V.4.2: Upper Basic - Enrolment by Shift, Grade & Gender

Grade 7		Grade 8		Grade 9		Total	
M	F	M	F	M	F	M	F

V.5.1: Lower Basic - Enrolment by Ethnicity, Grade & Gender

Ethnic Group	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Mandinka														
Fula Tukulur Lorobo														
Wollof														
Jola Karo ninka														
Sharahule														
Serere														
Creol Aku Marab														
Manjako														
Banbaran														
Foreigner (non Gambian)														
Other/ not Known														
Total														

V.5.2: Upper Basic - Enrolment by Ethnicity, Grade & Gender

Grade 7		Grade 8		Grade 9		Total	
M	F	M	F	M	F	M	F

V.6.1: Lower Basic - Special Needs Children

Special Needs Categories	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Vision														
Hearing														
Speaking														
Physical														
Mental														
Other														
Multiple Impairments														
Total														

V.6.2: Upper Basic - Special Needs Children

Grade 7		Grade 8		Grade 9		Total	
M	F	M	F	M	F	M	F

School Name: Type: **BCS** EMIS Code: Region:

VI. TEACHING STAFF DESCRIPTION

N°	Last Name	First Name(s)	Payroll No (If Not, ID Card No)	TIN Number	Gender (M or F)	Is Gambian (Nationality)?	Year of birth (last 2 digits)	Year of First Employm. as Teacher	Year of transfer in current school	Actual Status (1)	Is Teaching?	Grade(s) taught			Shift taught (M, A or D)	Nb of periods taught per week	Highest Educational Level (2)	Highest Professional Qualif. (3)	Subject(s) qualif. (4)		Subject(s) taught (4)		Education Level Attached (L or U)	Is New Teacher? (Start This Year)
												First	Second	More > 2 grades					Principal subject Qualif.	Secondary subject Qualif.	Principal subject taught	Secondary subject taught		
1																								
2																								
3																								
4																								
5																								
6																								
7	xviii																							
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								
16																								
17																								
18																								
19																								
20																								

(1) **(Actual Status)**: **HM**=Head Master / Principle , **DHM**=Deputy Head Master / Vice Principle , **SM**=Senior Master , **TT**=Teacher Trainee , **PTC**=Primary Teacher Certified , **HTC**=Higher Teacher Certified , **GT**=Graduate Teacher , **QQT**=Qualified Koranic Teacher , **UQQT**=Unqualified Koranic Teacher , **CT**=Contracted Teacher (Qualified) , **UQT**=Unqualified Teacher

(2) **(Highest Level of Education)**: **N**=None, **L**=Lower Basic, **U**=Upper Basic, **S**=Secondary, **C**=Certificate, **D**=Diploma, **B**=Bachelor Deg. , **M**=Masters Deg., **P**=PhD

(3) **(Highest Professional Qualif.)**: = **N**=None, **B**=BTC , **P**=PTC , **H**=HTC , **D**=Diploma Educ , **C**=Certificate , **M**=Management , **X**= Bachelor Educ. Or above

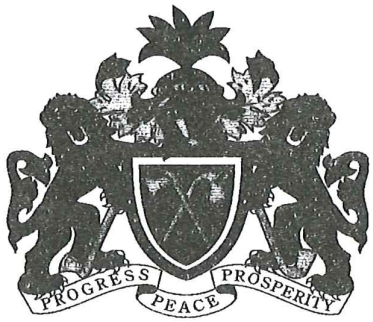
(4) **(Subjects)**: **E**=English , **M**=Maths , **SES** , **SC**=Science , **IS**=Integrated Studies , **O**=Others , **All**=LBS Subjects

Centre Name: ..... Type: ECD EMIS Code: | | | | | | Region: |

REPUBLIC OF THE GAMBIA

Progress - Peace – Prosperity

-----oOo-----



ANNUAL SCHOOL CENSUS

2018 / 2019

ECD Centre

MINISTRY OF BASIC AND SECONDARY EDUCATION (MoBSE)

Directorate of Planning, Policy Analysis, Research and Budgeting (DPPARBD)

STATISTICS& EMIS & ICT UNITS

*To be filled by **functional schools** only.*
Carefully Read Accompanying Instructions Before Completing. Strictly Confidential.

I. MAIN CENTRE DETAILS

Centrename: "SchoolType": ECD

Centre Code: **Functioning Status?** Old (Known) ☐ New ☐ Closed ☐ Region:

Is Madrasa Centre?(*Tick if Yes*) ☐ → If **Yes**, Indicate**Type of Madrasa**: (M or N) Year Established:

Centre Ownership? Government ☐ Mission ☐ Private ☐ WFP?: (*Tick If Yes*) ☐

Centre Attached to LBS?(*Tick if Yes*) ☐ If **Yes**, which **LBS?**

Sponsoring Org/Agency: Model Centre: Support Centre:

District Cluster Name:

Ward: Settlement:

HeadTeacher: Email:

Contact 1: Contact 2: Fax No: PO Box:

Nearest **LBS/BCS**: Distance to Nearest **LBS/BCS**: (Km)

Data Collection verification & endorsement

Data Collected (Team Leader):

By: _____

Remarks: _____

Date: ..... /..... /..... Signature: .....

Data Provided (at School level):

By: _____

Contact: _____

Stamp:

Signature: .....

Data Entry verification & validation

Data Entered by: Remarks:

Data Verified by:

Centre Name: ..... Type: ECD EMIS Code: | | | | | | Region: |

II. CENTREGENERALINFORMATION

II.1: Physical Facilities

Where do you hold classes/lessons? *(Tick one)* Permanent Structure: ☐ Temporary Structure: ☐ No Structure: ☐

II.2: Sanitation / Water / Utilities:

Sanitation	
Number of Teachers Toilet:	
Number of Boys Toilet:	
Number of Girls Toilet:	
Distance between boys & girls toilets:	

Drinking Water Resources	
Number of Taps:	
Number of well:	
Number of Pumps:	

Power Utilities	
NAWEC?	☐
Generator?	☐
Solar Power?	☐

Other	
Playing Ground?	☐
Furniture?	☐
Health Care Link?	☐

III. LEANERS / ATTENDANCE

III.1: Learners by Age, Level &Gender

Age	Level 1		Level 2		Level 3		Level 4		Total	
	M	F	M	F	M	F	M	F	M	F
<=2										
3										
4										
5										
6										
>=7										
Total										

Total Enrolment (ECD) :

IV. CLASSES / LESSONS

IV.1: Number of Classes by Shift &Level

Shifts	Level 1	Level 2	Level 3	Level 4	Total
Morning					
Afternoon					
Total					

IV.3: Language of Instruction

Language	*(Tick all that apply)*
English	☐
Arabic	☐
Mandinka	☐
Wollof	☐
Pullar	☐
Jolla	☐
Other(Specify).....	☐

IV.2: Activities/Subjects *(Tick level if subject applies)*

Enter the activity/subject	Level 1	Level 2	Level 3	Level 4
1.....	☐	☐	☐	☐
2.....	☐	☐	☐	☐
3.....	☐	☐	☐	☐
4.....	☐	☐	☐	☐
5.....	☐	☐	☐	☐
6.....	☐	☐	☐	☐
7.....	☐	☐	☐	☐
8.....	☐	☐	☐	☐
9.....	☐	☐	☐	☐
10.....	☐	☐	☐	☐

Centre Name: ..... Type: ECD EMIS Code: | | | | | | Region: |

V. SPECIAL NEEDS

V.1: Special Needs Children

Special Needs Categories	Level 1		Level 2		Level 3		Level 4		Total	
	M	F	M	F	M	F	M	F	M	F
Vision										
Hearing										
Speaking										
Physical										
Mental										
Other										
Multiple Impairments										
Total										

V.2: Special Needs Teachers

Does special needs children receive visits of (itinerant) trained special needs teachers? ❑

V.3: Special Needs Resources

Special Needs Aids	Available?
Special Furniture	❑
Deaf Aids	❑
Vision Aids	❑
Physical Difficulty Aids	❑
Other Aids	❑

V.4: Special Needs Services

Special Needs Categories	Disability Assessment?
Vision	❑
Hearing	❑
Speaking	❑
Physical	❑
Mental	❑
Other	❑

VI. AVAILABLE RESSOURCES

a. Number of Pupils Book/Text Resources (Total Useable Copies) by Subject& Level

Subjects	Level 1	Level 2	Level 3	Level 4
1.....				
2.....				
3.....				
4.....				
5.....				

b. The number of Books/Texts is: sufficient for all classes ❑ sufficient for some classes ❑ no text available ❑

c. The material contained in the Books/Texts: covers all subjects ❑ covers some subjects ❑ no text available ❑

d. List the Non-Book/Text resources available at the centre:

e. Other teaching/learning resources are: sufficient for all classes ❑ sufficient for some classes ❑ No resources ❑

f. The available resources: covers all subjects ❑ covers some subjects ❑ No resources ❑

XX

Centre Name: ..... Type: **ECD** EMIS Code: Region:

VII.TEACHING STAFF DESCRIPTION

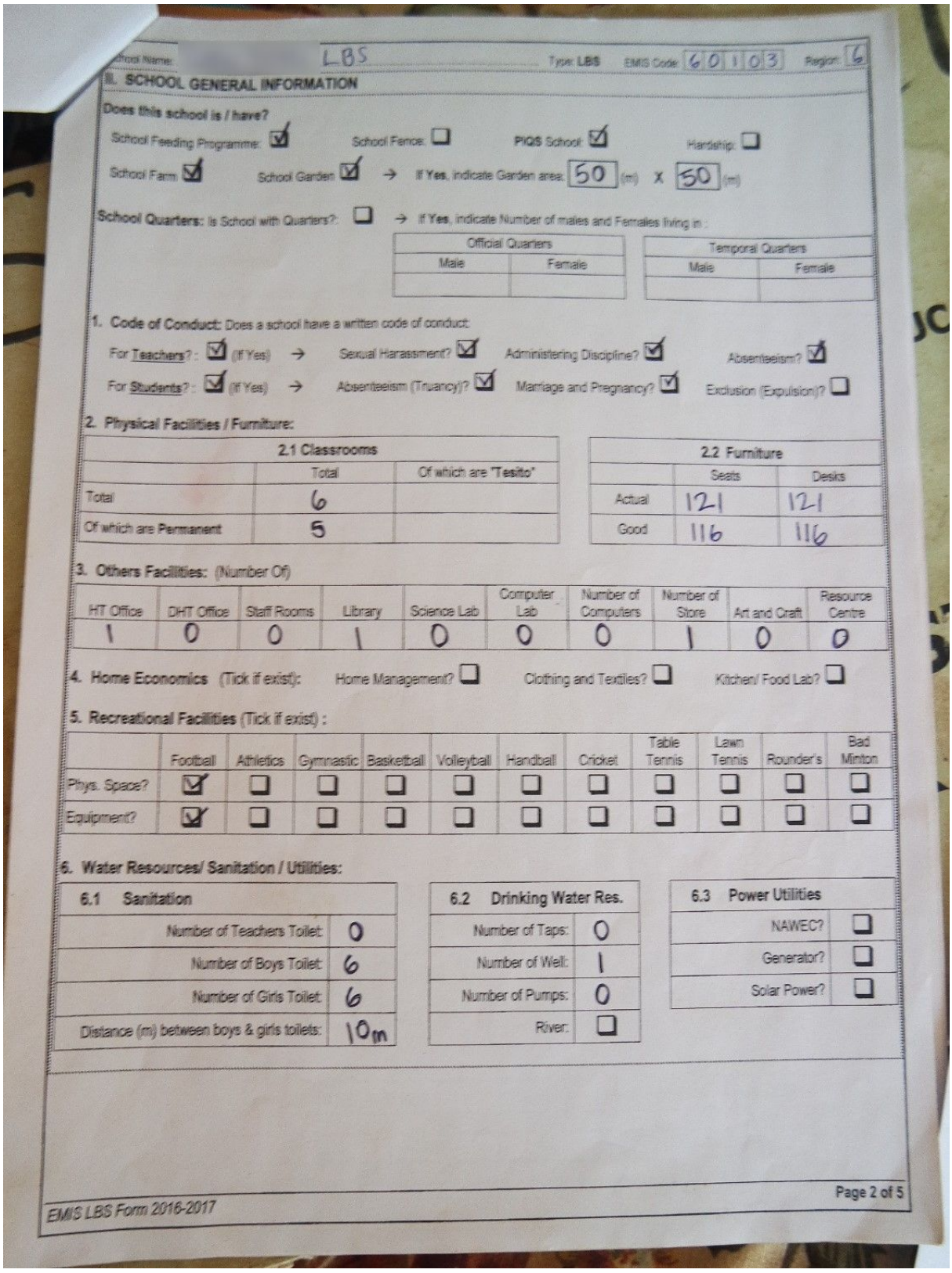
N°	Last Name	First Name(s)	Payroll No (If Not, ID Card No)	TIN Number	Gender (M or F)	Is Gambian (Nationality)?	Year of birth (last 2 digits)	Year of First Employm. as Teacher	Year of transfer in current school	Actual Status (1)	Is Teaching?	Level(s) taught			Shift taught (M, A or D)	Nb of periods taught per week	Highest Educational Level (2)	Highest Professional Qualif. (3)	Subject(s) qualif. (4)		Subject(s) taught (4)		Education Level Attached (ECD)	Is New Teacher? (Start This Year)
												First	Second	More > 2 Levels					Principal subject Qualif.	Secondary subject Qualif.	Principal subject taught	Secondary subject taught		
1						☐					☐			☐									E	☐
2						☐					☐			☐									E	☐
3						☐					☐			☐									E	☐
4						☐					☐			☐									E	☐
5						☐					☐			☐									E	☐
6						☐					☐			☐									E	☐
7	XX					☐					☐			☐									E	☐
8						☐					☐			☐									E	☐
9						☐					☐			☐									E	☐
10						☐					☐			☐									E	☐
11						☐					☐			☐									E	☐
12						☐					☐			☐									E	☐
13						☐					☐			☐									E	☐
14						☐					☐			☐									E	☐
15						☐					☐			☐									E	☐
16						☐					☐			☐									E	☐
17						☐					☐			☐									E	☐
18						☐					☐			☐									E	☐
19						☐					☐			☐									E	☐
20						☐					☐			☐									E	☐

(1) **(Actual Status)**: **HM**=Head Master / Principle , **DHM**=Deputy Head Master / Vice Principle , **QT**= Qualified Teacher , **QQT**=Qualified Koranic Teacher , **UQT**=Unqualified Teacher, **UQQT**=Unqualified Koranic Teacher, **TT**=Teacher Trainee

(2) **(Highest Level of Education)**: **N**=None, **L**=Lower Basic, **U**=Upper Basic, **S**=Secondary, **C**=Certificate, **D**=Diploma, **B**=Bachelor Deg. , **M**=Masters Deg., **P**=PhD

(3) **(Highest Professional Qualif.)**: **U**=Untrained, **T**=Trained

(4) **(Subjects)**: **E**=English , **M**=Maths , **O**=Others,**All**=All



School Name: [redacted] LBS Type: LBS EMIS Code: 6 0 1 0 3 Region: 6

II. SCHOOL GENERAL INFORMATION

Does this school is / have?

School Feeding Programme: ☑ School Fence: ☐ PIQS School: ☑ Hardship: ☐

School Farm: ☑ School Garden: ☑ → If Yes, indicate Garden area: 50 (m) x 50 (m)

School Quarters: Is School with Quarters?: ☐ → If Yes, indicate Number of males and Females living in :

Official Quarters		Temporal Quarters	
Male	Female	Male	Female

1. **Code of Conduct:** Does a school have a written code of conduct:

For Teachers? : ☑ (If Yes) → Sexual Harassment? ☑ Administering Discipline? ☑ Absenteeism? ☑

For Students? : ☑ (If Yes) → Absenteeism (Truancy)? ☑ Marriage and Pregnancy? ☑ Exclusion (Expulsion)? ☐

2. **Physical Facilities / Furniture:**

2.1 Classrooms		
	Total	Of which are "Tesito"
Total	6	
Of which are Permanent	5	

2.2 Furniture		
	Seats	Desks
Actual	121	121
Good	116	116

3. **Others Facilities:** (Number Of)

HT Office	DHT Office	Staff Rooms	Library	Science Lab	Computer Lab	Number of Computers	Number of Store	Art and Craft	Resource Centre
1	0	0	1	0	0	0	1	0	0

4. **Home Economics** (Tick if exist): Home Management? ☐ Clothing and Textiles? ☐ Kitchen/ Food Lab? ☐

5. **Recreational Facilities** (Tick if exist) :

	Football	Athletics	Gymnastic	Basketball	Volleyball	Handball	Cricket	Table Tennis	Lawn Tennis	Rounder's	Bad Minton
Phys. Space?	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment?	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

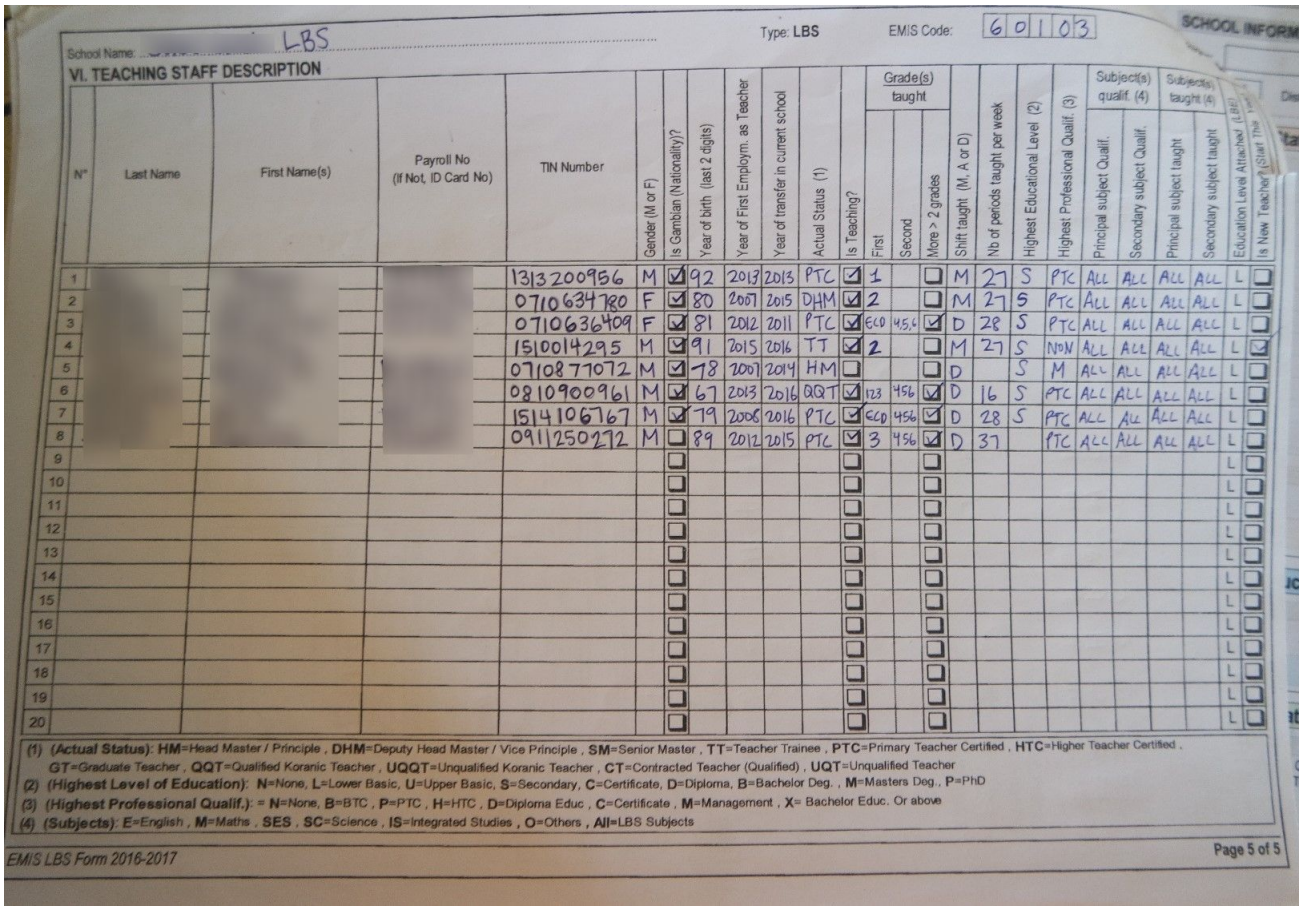
6. **Water Resources/ Sanitation / Utilities:**

6.1 Sanitation	
Number of Teachers Toilet:	0
Number of Boys Toilet:	6
Number of Girls Toilet:	6
Distance (m) between boys & girls toilets:	10m

6.2 Drinking Water Res.	
Number of Taps:	0
Number of Well:	1
Number of Pumps:	0
River:	☐

6.3 Power Utilities	
NAWEC?	☐
Generator?	☐
Solar Power?	☐

Figure A.1: ASC at rural school



School Name: [redacted] LBS — Type: LBS — EMIS Code: 6 0 1 0 3 — SCHOOL INFORM

VI. TEACHING STAFF DESCRIPTION

N°	Last Name	First Name(s)	Payroll No (If Not, ID Card No)	TIN Number	Gender (M or F)	Is Gambian (Nationality)?	Year of birth (last 2 digits)	Year of First Employm. as Teacher	Year of transfer in current school	Actual Status (1)	Is Teaching?	Grade(s) taught: First	Second	More > 2 grades	Shift taught (M, A or D)	Nb of periods taught per week	Highest Educational Level (2)	Highest Professional Qualif. (3)	Subject(s) qualif. (4): Principal subject Qualif.	Secondary subject Qualif.	Subject(s) taught (4): Principal subject taught	Secondary subject taught	Education Level Attached (LBE)	Is New Teacher (Start This ...
1	[redacted]	[redacted]	[redacted]	1313200956	M	☑	92	2013	2013	PTC	☑	1		☐	M	27	S	PTC	ALL	ALL	ALL	ALL	L	☐
2				0710634780	F	☑	80	2007	2015	DHM	☑	2		☐	M	27	S	PTC	ALL	ALL	ALL	ALL	L	☐
3				0710636409	F	☑	81	2012	2011	PTC	☑	ECD	4,5,6	☑	D	28	S	PTC	ALL	ALL	ALL	ALL	L	☐
4				1510014295	M	☑	91	2015	2016	TT	☑	2		☐	M	27	S	NON	ALL	ALL	ALL	ALL	L	☑
5				0710877072	M	☑	78	2007	2014	HM	☐			☐	D		S	M	ALL	ALL	ALL	ALL	L	☐
6				0810900961	M	☑	67	2013	2016	QQT	☑	123	456	☑	D	16	S	PTC	ALL	ALL	ALL	ALL	L	☐
7				1514106767	M	☑	79	2006	2016	PTC	☑	ECD	456	☑	D	28	S	PTC	ALL	ALL	ALL	ALL	L	☐
8				0911250272	M	☐	89	2012	2015	PTC	☑	3	456	☑	D	37		PTC	ALL	ALL	ALL	ALL	L	☐
9						☐					☐			☐									L	☐
10						☐					☐			☐									L	☐
11						☐					☐			☐									L	☐
12						☐					☐			☐									L	☐
13						☐					☐			☐									L	☐
14						☐					☐			☐									L	☐
15						☐					☐			☐									L	☐
16						☐					☐			☐									L	☐
17						☐					☐			☐									L	☐
18						☐					☐			☐									L	☐
19						☐					☐			☐									L	☐
20						☐					☐			☐									L	☐

(1) **(Actual Status)**: **HM**=Head Master / Principle , **DHM**=Deputy Head Master / Vice Principle , **SM**=Senior Master , **TT**=Teacher Trainee , **PTC**=Primary Teacher Certified , **HTC**=Higher Teacher Certified , **GT**=Graduate Teacher , **QQT**=Qualified Koranic Teacher , **UQQT**=Unqualified Koranic Teacher , **CT**=Contracted Teacher (Qualified) , **UQT**=Unqualified Teacher

(2) **(Highest Level of Education)**: **N**=None, **L**=Lower Basic, **U**=Upper Basic, **S**=Secondary, **C**=Certificate, **D**=Diploma, **B**=Bachelor Deg. , **M**=Masters Deg., **P**=PhD

(3) **(Highest Professional Qualif.)**: = **N**=None, **B**=BTC , **P**=PTC , **H**=HTC , **D**=Diploma Educ , **C**=Certificate , **M**=Management , **X**= Bachelor Educ. Or above

(4) **(Subjects)**: **E**=English , **M**=Maths , **SES** , **SC**=Science , **IS**=Integrated Studies , **O**=Others , **All**=LBS Subjects

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Figure A.2: ASC - Teacher Staff Description at rural school

A.1.2 School Admission Register

The next page show a reproduction of the *School Admission Register* sheet used at both the urban and rural school.

MINISTRY OF BASIC AND SECONDARY EDUCATION

SCHOOL ADMISSION REGISTER

1	2	3	4	5	6	7	8	9	10	11
Admission Number	**Name**	**Approx. date of birth**	**Date of Admission**	**Name of Parent/Guardian**	**Address of Parent/Guardian**	**Parents' Religion**	**Previous School and Class**	**Class as at Previous School**	**Incoming transfer Cert. No.**	**Outgoing transfer Cert. No.**

A.2 Daily

A.2.1 Pupil Attendance Register

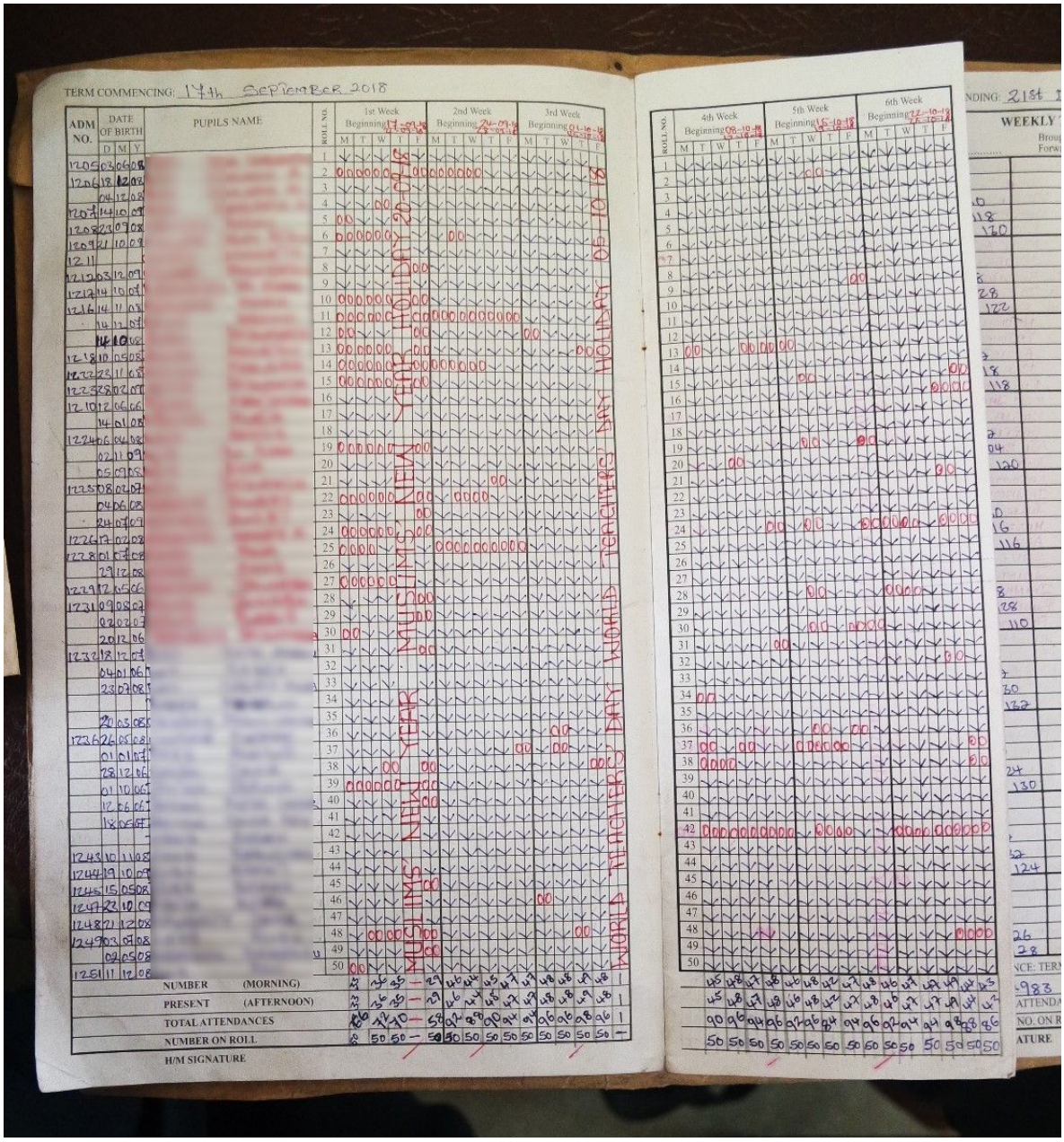

Figure A.3: Pupil Attendance Register

The next two pages show a reproduction of some pages of the *Pupil Attendance Register* used at the urban school.

Adm no.	Date of birth			Pupils name	Roll no.	1st week beginning dd/mm/yyyy – dd/mm/yyyy										N-week beginning dd/mm/yyyy – dd/mm/yyyy									
	D	M	Y			M		T		W		T		F		M		T		W		T		F	
					1																				
					2																				
					3																				
					4																				
					5																				
					6																				
					7																				
					8																				
					9																				
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					18																				
					19																				
					20																				
					21																				
					22																				
					23																				
					24																				
					25																				
Number (Morning)																									
Present (Afternoon)																									
Total Attendances																									
Number on roll					25																				

H/M Signature:

Term ending: _____

	Weekly Totals															Weekly Totals		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Term	Brought forward	Total
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
																Attendance: Term Total:		
																Number Number M: A: Total:		
																Average attendance		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average no. on register		

H/M Signature

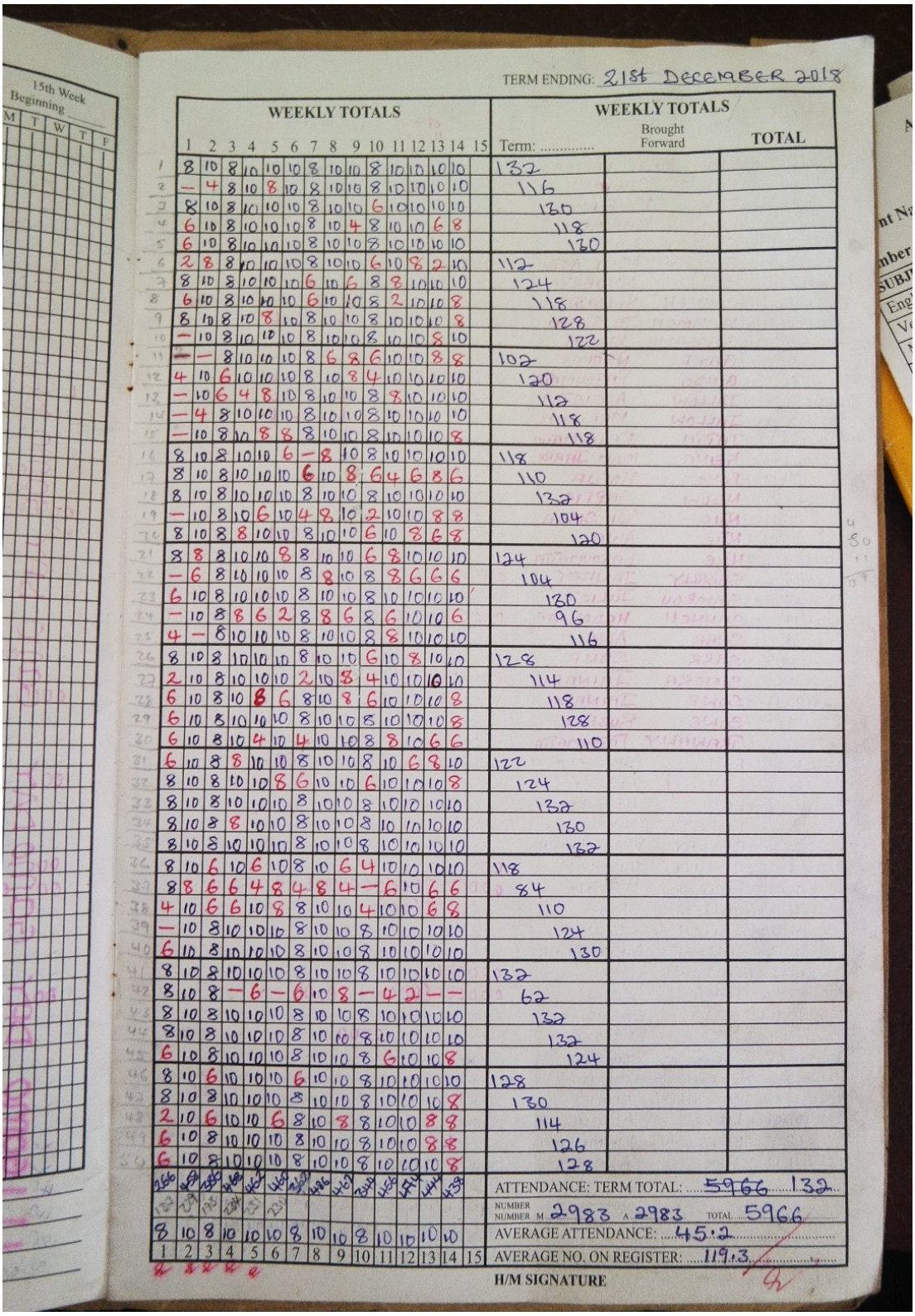


Figure A.4: An example of the pupil attendance register. This is the last page in a term, where they sum up the totals

A.2.2 Teacher Attendance Register

Table A.1: Data elements in the Teacher Attendance Register at urban school

Date	Name	Arrival time	Signature	Remark
dd/mm/yyyy				
1	xxxx	hh/mm	xxxx	Sick/permission/etc.
2	xxxx	hh/mm	xxxx	

Table A.2: Data elements in the Teacher Attendance Register at the rural school

Date	Name	Arrived time	Departed time	Signature
dd/mm/yyyy	xxxx	hh/mm	hh/mm	xxxx.

A.2.3 Total Attendance Register

PM/AM Morning or afternoon shift

T Total Staff

TP Total Present

AP Absent with permission

AW Absent without permission

LA Late for more than 30 minutes

LB Late for less than 30 minutes

SE Total Enrollment

SP Total Present

SA Total Absent

An example from the book

The data elements the teacher have to keep track of everyday:

Date (DD/MM)	PM/AM	T	TP	AP	AW	LA	LB	SE	SP	SA
12.03	AM	15	10	3	1	0	0	790	780	10

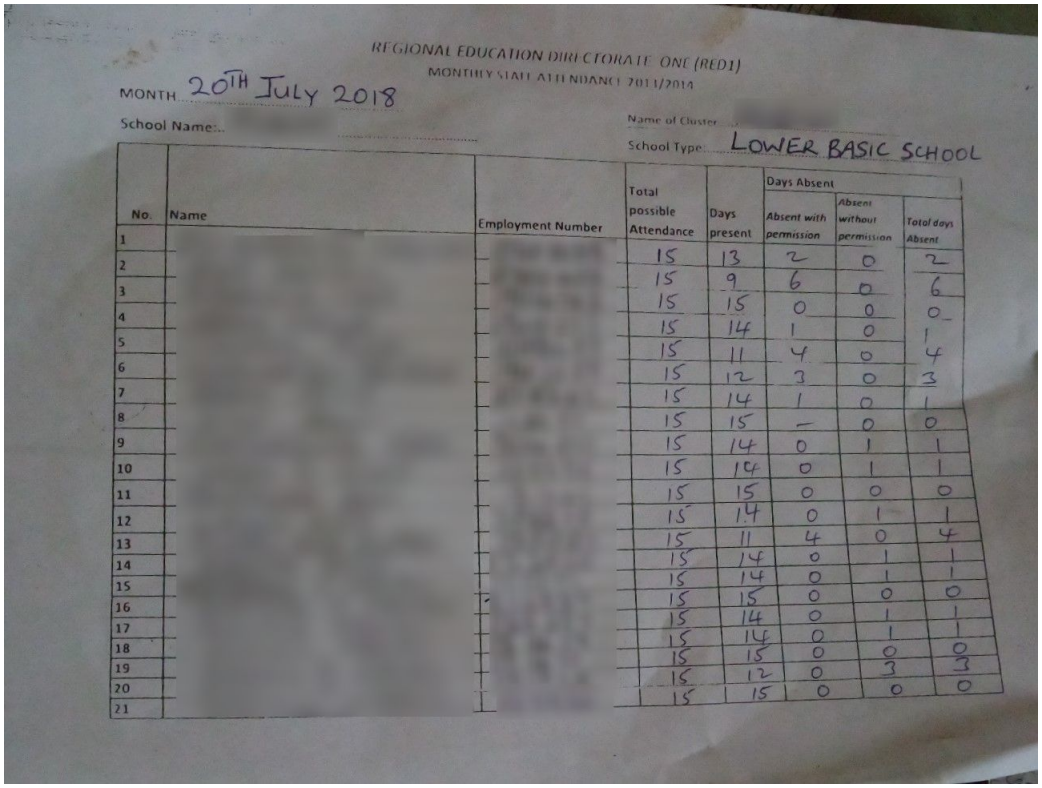
A.2.4 Attendance Reporting (SMS)

An example of the SMS query to be sent from the information above:

1203,AM,T15,TP10,AP3,AW1,LA0,LB0,SE790,SP780,SA10

A.3 Monthly

A.3.1 Monthly Staff Attendance



REGIONAL EDUCATION DIRECTORATE ONE (RED1)
MONTHLY STAFF ATTENDANCE 2013/2014

MONTH 20TH JULY 2018

School Name:

Name of Cluster

School Type: LOWER BASIC SCHOOL

No.	Name	Employment Number	Total possible Attendance	Days present	Days Absent		
					Absent with permission	Absent without permission	Total days Absent
1			15	13	2	0	2
2			15	9	6	0	6
3			15	15	0	0	0
4			15	14	1	0	1
5			15	11	4	0	4
6			15	12	3	0	3
7			15	14	1	0	1
8			15	15	–	0	0
9			15	14	0	1	1
10			15	14	0	1	1
11			15	15	0	0	0
12			15	14	0	1	1
13			15	11	4	0	4
14			15	14	0	1	1
15			15	14	0	1	1
16			15	15	0	0	0
17			15	14	0	1	1
18			15	14	0	1	1
19			15	15	0	0	0
20			15	12	0	3	3
21			15	15	0	0	0

Figure A.5: Monthly Staff Attendance

The next page show a reproduction of the *Monthly Staff Attendance* sheet used at the urban school

REGIONAL EDUCATION DIRECTORATE ONE (RED1)

MONTHLY STAFF ATTENDANCE 2018/2019

MONTH…… **Name of Cluster……**

School Name:…….. **School Type:…….**

No.	Name	Employment Number	Total possible Attendance	Days present	Days Absent		
					Absent with permission	*Absent without permission*	*Total days Absent*
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

A.3.2 Staff and pupil attendance sheet

The next page show a reproduction of the *Staff and pupil attendance sheet* used at the rural school.

REGIONAL EDUCATION DIRECTORATE SIX, STAFF AND PUPILS ATTENDANCE SHEET

NAME OF SCHOOL:…….. TERM:…..MONTH:…….YEAR:……H/T:……

CONTACT NUMBERS:……..

	DATE	SHIFT	NO OF STAFF	TOTAL PRESENT	LATE FOR <30 MIN.	LATE FOR >30 MIN.	ABSENT ON PERM	ABSENT WITHOUT	STUDENT ENROL.	STUDENT PRESENT	STUDENT ABSENT
1		AM									
		PM									
2		AM									
		PM									
3		AM									
		PM									
4		AM									
		PM									
5		AM									
		PM									
6		AM									
		PM									
7		AM									
		PM									
8		AM									
		PM									
9		AM									
		PM									
10		AM									
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11		AM									
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13		AM									
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14		AM									
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15		AM									
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16		AM									
		PM									
17		AM									
		PM									
18		AM									
		PM									
19		AM									
		PM									
20		AM									
		PM									
21		AM									
		PM									
22		AM									
		PM									
23		AM									
		PM									
ENTERED BY:…… SIGN……DATE:……											
VARIFIED BY:…… SIGN:…… DATE:……											

NB: FILLED ATTENDANCE SHEET SHOULD BE SUBMITTED ON OR BEFORE THE 10TH DAY OF THE FOLLOWING MONTH.

A.4 Other

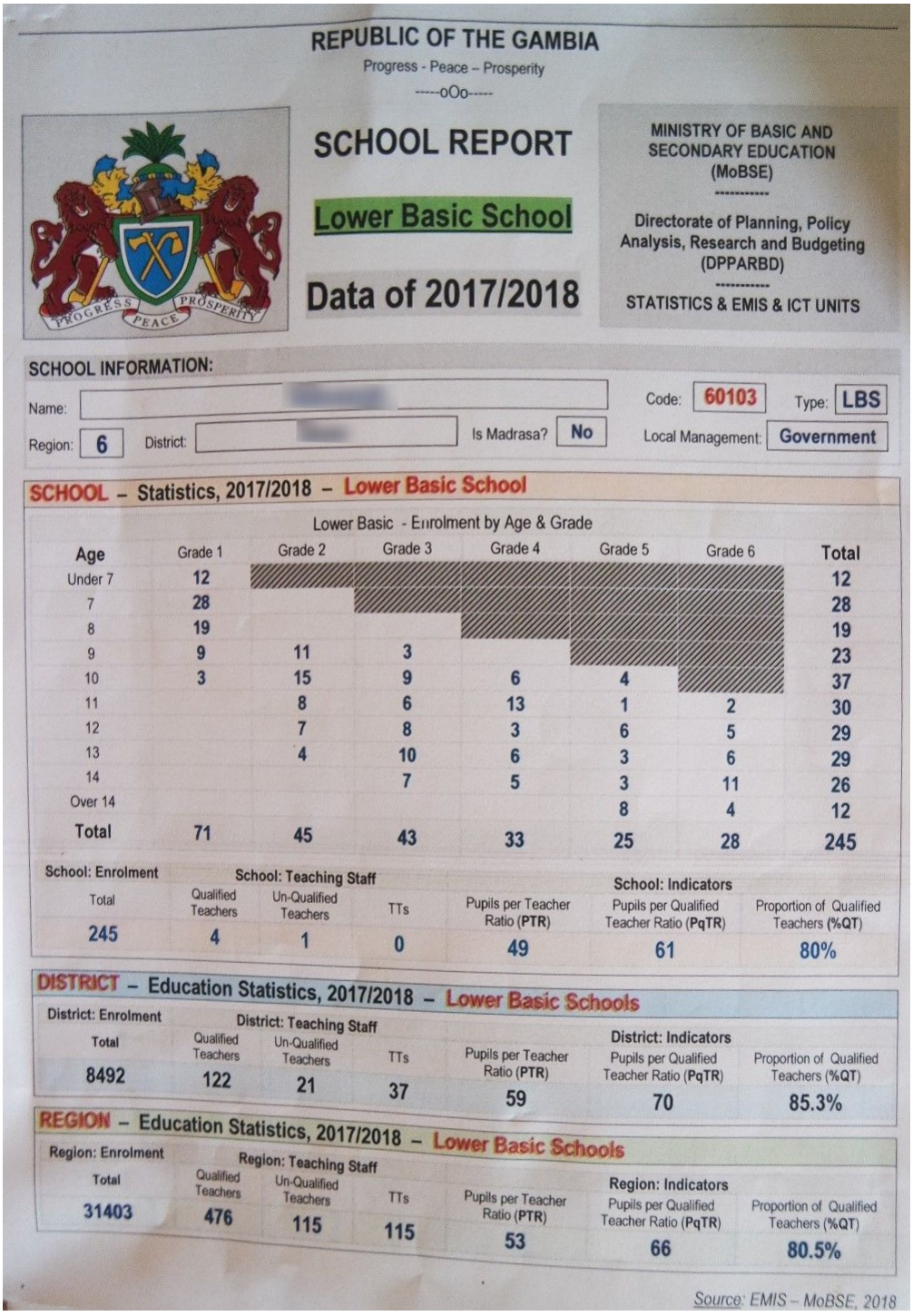
A.4.1 Report forms

The report forms consist of a pupil's subjects, the highest possible score in terms of a grade or a number, and the pupil's achieved score. It also provides information about the position in class, attendance, conduct/merit, and other general remarks.

A.4.2 School Report

A.4.3 Tests, exams and grades

Figure A.8: The class' score in different subjects at urban school



REPUBLIC OF THE GAMBIA

Progress - Peace – Prosperity

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SCHOOL REPORT

Lower Basic School

Data of 2017/2018

MINISTRY OF BASIC AND SECONDARY EDUCATION (MoBSE)

Directorate of Planning, Policy Analysis, Research and Budgeting (DPPARBD)

STATISTICS & EMIS & ICT UNITS

SCHOOL INFORMATION:

Name: [redacted] Code: 60103 Type: LBS

Region: 6 District: [redacted] Is Madrasa? No Local Management: Government

SCHOOL – Statistics, 2017/2018 – Lower Basic School

Lower Basic - Enrolment by Age & Grade

Age	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Total
Under 7	12						12
7	28						28
8	19						19
9	9	11	3				23
10	3	15	9	6	4		37
11		8	6	13	1	2	30
12		7	8	3	6	5	29
13		4	10	6	3	6	29
14			7	5	3	11	26
Over 14					8	4	12
Total	71	45	43	33	25	28	245

School: Enrolment	School: Teaching Staff			School: Indicators		
Total	Qualified Teachers	Un-Qualified Teachers	TTs	Pupils per Teacher Ratio (PTR)	Pupils per Qualified Teacher Ratio (PqTR)	Proportion of Qualified Teachers (%QT)
245	4	1	0	49	61	80%

DISTRICT – Education Statistics, 2017/2018 – Lower Basic Schools

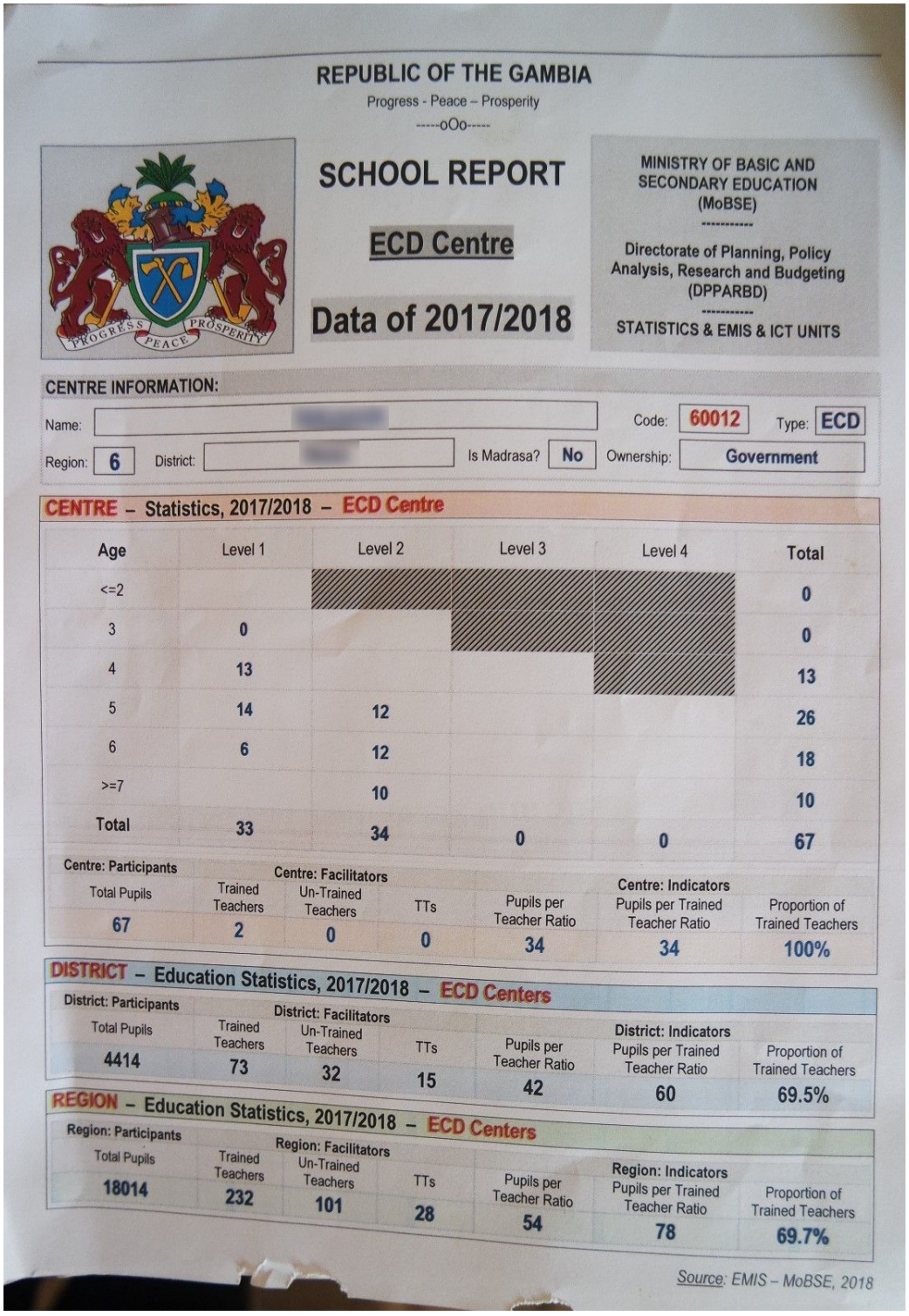
District: Enrolment	District: Teaching Staff			District: Indicators		
Total	Qualified Teachers	Un-Qualified Teachers	TTs	Pupils per Teacher Ratio (PTR)	Pupils per Qualified Teacher Ratio (PqTR)	Proportion of Qualified Teachers (%QT)
8492	122	21	37	59	70	85.3%

REGION – Education Statistics, 2017/2018 – Lower Basic Schools

Region: Enrolment	Region: Teaching Staff			Region: Indicators		
Total	Qualified Teachers	Un-Qualified Teachers	TTs	Pupils per Teacher Ratio (PTR)	Pupils per Qualified Teacher Ratio (PqTR)	Proportion of Qualified Teachers (%QT)
31403	476	115	115	53	66	80.5%

Source: EMIS – MoBSE, 2018

Figure A.6: School report for LBS at rural school



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SCHOOL REPORT

ECD Centre

Data of 2017/2018

MINISTRY OF BASIC AND SECONDARY EDUCATION (MoBSE)

Directorate of Planning, Policy Analysis, Research and Budgeting (DPPARBD)

STATISTICS & EMIS & ICT UNITS

CENTRE INFORMATION:

Name: [redacted] Code: 60012 Type: ECD

Region: 6 District: [redacted] Is Madrasa? No Ownership: Government

CENTRE – Statistics, 2017/2018 – ECD Centre

Age	Level 1	Level 2	Level 3	Level 4	Total
<=2					0
3	0				0
4	13				13
5	14	12			26
6	6	12			18
>=7		10			10
Total	33	34	0	0	67

Centre: Participants	Centre: Facilitators			Centre: Indicators		
Total Pupils	Trained Teachers	Un-Trained Teachers	TTs	Pupils per Teacher Ratio	Pupils per Trained Teacher Ratio	Proportion of Trained Teachers
67	2	0	0	34	34	100%

DISTRICT – Education Statistics, 2017/2018 – ECD Centers

District: Participants	District: Facilitators			District: Indicators		
Total Pupils	Trained Teachers	Un-Trained Teachers	TTs	Pupils per Teacher Ratio	Pupils per Trained Teacher Ratio	Proportion of Trained Teachers
4414	73	32	15	42	60	69.5%

REGION – Education Statistics, 2017/2018 – ECD Centers

Region: Participants	Region: Facilitators			Region: Indicators		
Total Pupils	Trained Teachers	Un-Trained Teachers	TTs	Pupils per Teacher Ratio	Pupils per Trained Teacher Ratio	Proportion of Trained Teachers
18014	232	101	28	54	78	69.7%

Source: EMIS – MoBSE, 2018

Figure A.7: School report for ECD at rural school

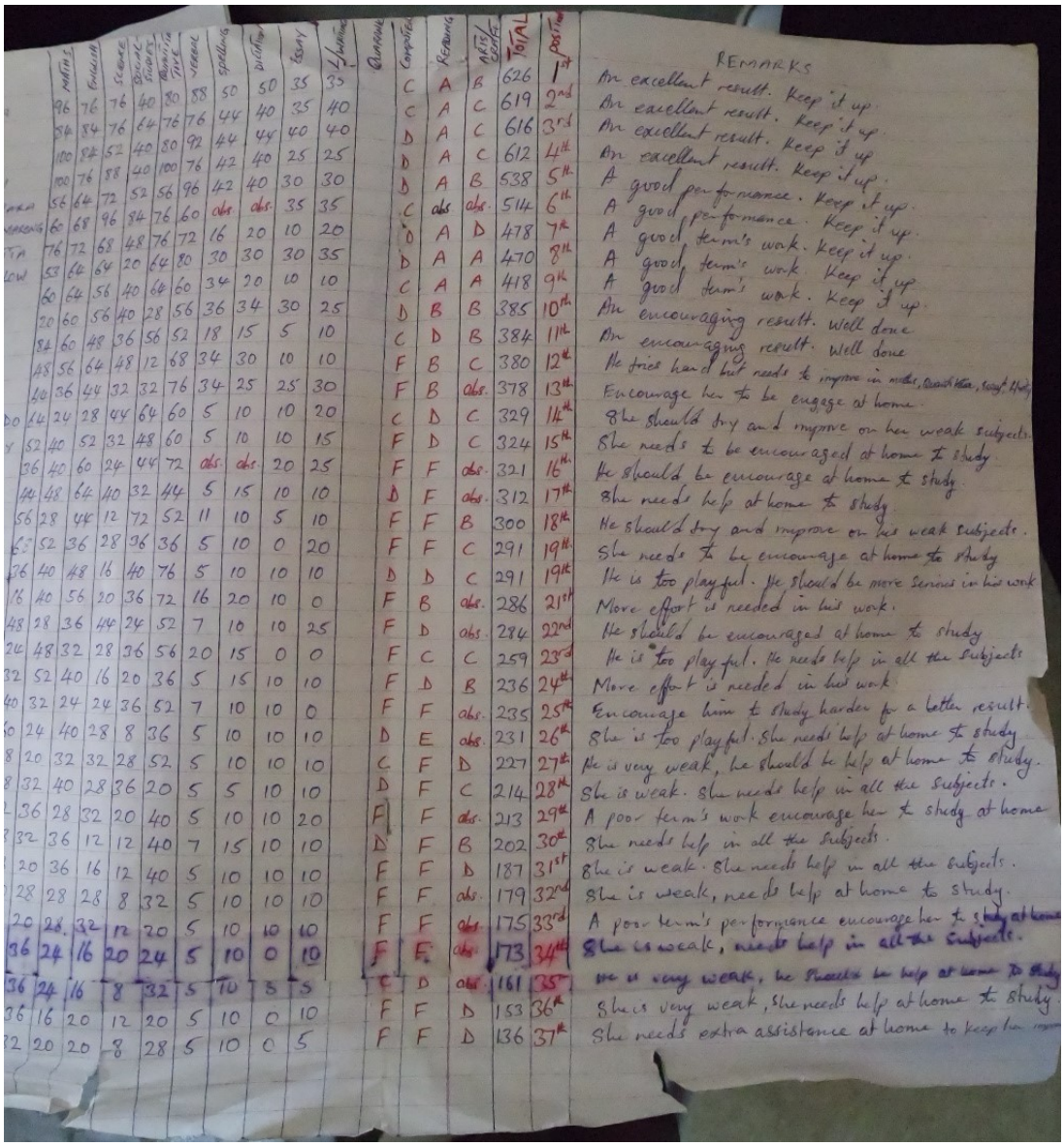

Figure A.9: All pupils score in a class after a term at urban school

Figure A.9 show the teachers effort to display their pupils' grades. First, they display all the different pupils subject with a score, three of the subjects with a letter grading, and then they provide an overall score out of the subjects with numbered scores, and then their position in the class. At the end are some remarks to the children.

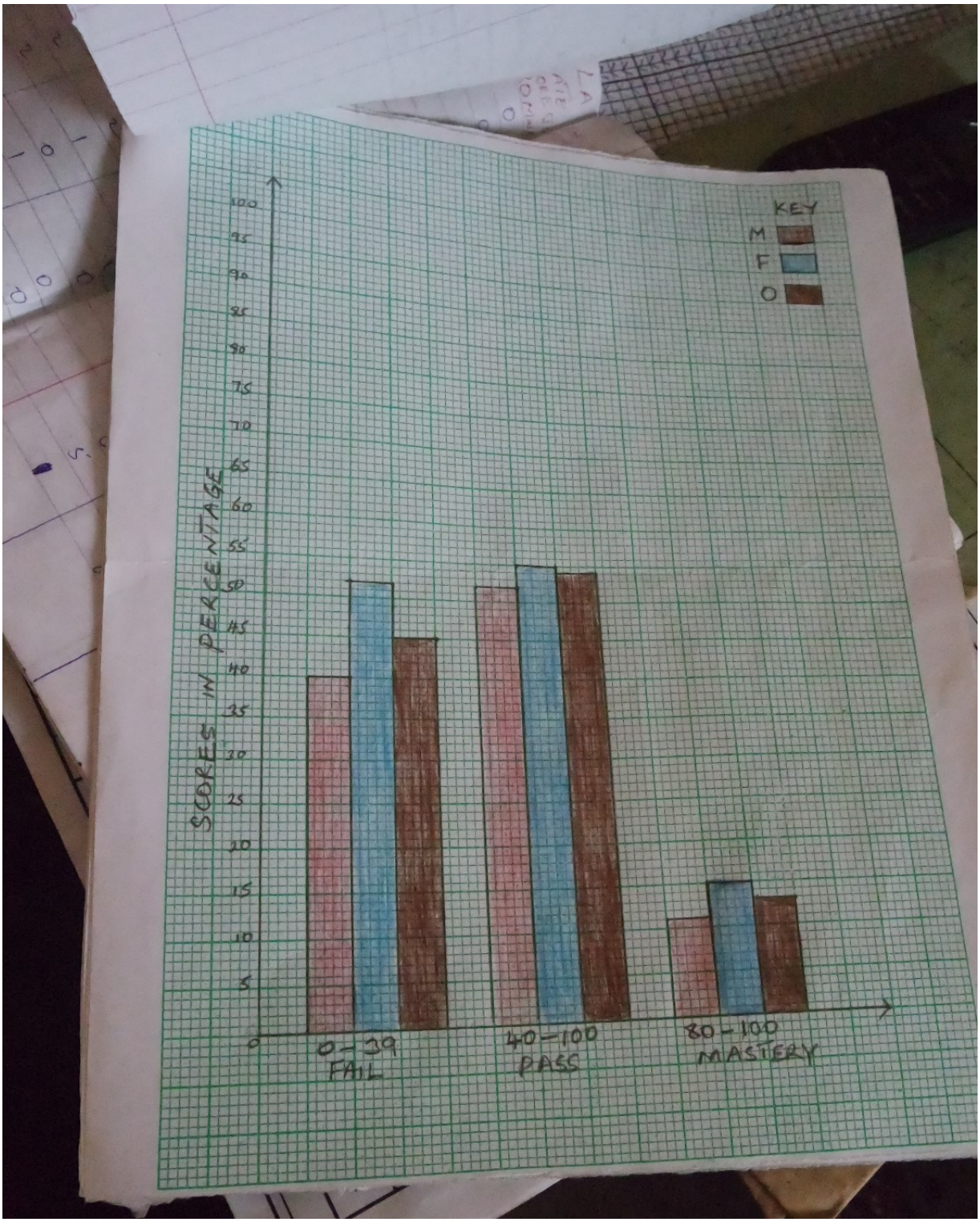

Figure A.10: The class' score

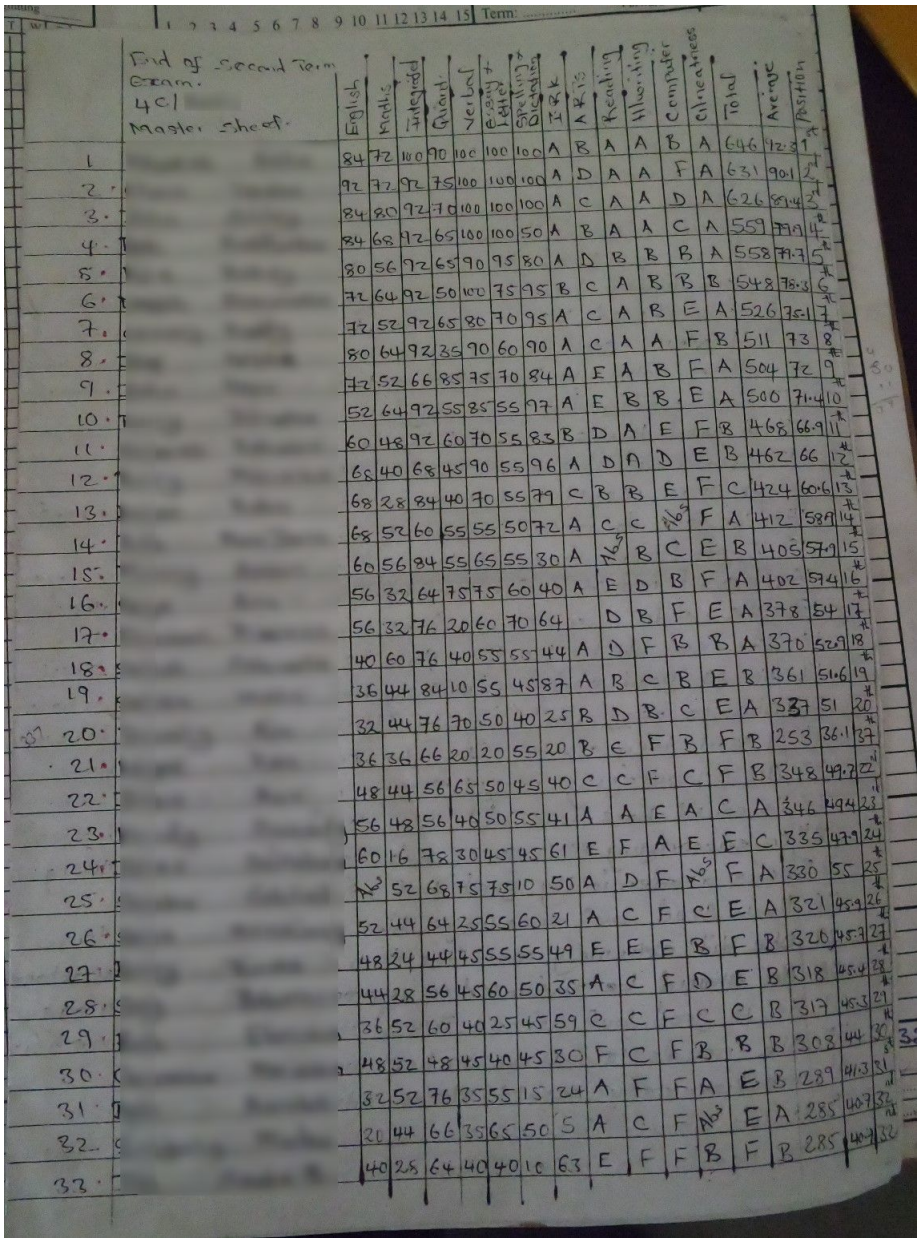

Figure A.11: All pupils score in a class after 2nd term