

**FACTORS AFFECTING TECHNICAL EFFICIENCY IN UNIVERSAL SECONDARY
SCHOOLS IN WESTERN UGANDA**

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DECLARATION

I, Balinda Eskar Baingana Richardson, declare that this PhD thesis is my original work. Any literature used to develop the thesis arguments has been acknowledged. The ideas presented in this report are original and aim to improve management and performance in universal secondary schools in Western Uganda and Uganda as a whole.

Signature.....

Date: 10/06/2025

Balinda Eskar Baingana Richardson

APPROVAL

This is to certify that this PhD thesis satisfies the requirements for the award of the degree of Doctor of Philosophy in Education Administration and Management from Uganda Christian University. It has been under our supervision and guidance, and we therefore accept to forward it to the School of Research and Postgraduate Studies with our approval.

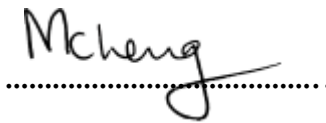
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Date 10/6/2025

DEDICATION

I dedicate this work to my loving God the Father, God the Son and God the Holy Spirit, my ever loving wife-Balinda H.Hellen my supportive children,Elizabeth Jayde Kaganzi, Gabriel Noble Kwesiga ,Victor Golden Murungi, Luke Humphrey Amana, Angel Treasure Karunga and Winnie Ninsiima Kasemire and all my other adopted children, my parents and Guardians,brothers , Cousins, friends, teaching and none teaching staff of Kyebambe and Nyakasura schools, my prayer partners and brethren of EastAfrican revival. All of you note that, without your individual and combined effort, this report would not have been completed.

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LIST OF ACRONYMS

AE	Allocative efficiency
COVID-19	Corona Virus Disease - 19
CRS	Constant Returns to Scale
D. E. O	District Education Officer
DEA	Data Enveloping Analysis
DMU	Decision-Making Unit
DRS	Decreasing Returns to Scale
GDP	Gross Domestic Product
GER	Gross Enrolment Ratio
HSC	Higher School Certificate
IDCJ	International Development Centre of Japan
IRS	Increasing Returns to Scale
JICA	Japan International Cooperation Agency
LMIC	Low- And Middle-Income
MDG	Millennium Development Goal
MoES	Ministry Of Education and Sports of Uganda
OECD	Organization for Economic Cooperation and Development
O Level	Ordinary level
PPP	Public-Private Partnership

PTA	Parent Teacher Association
SC	School Certificate
SDG	Sustainable Development Goals
U.C. E	Uganda Certificate of Education
U.S.E	Universal Secondary Education
UNESCO	United Nations Environmental and Sociocultural organization
UNICEF	United Nations International Children’s Emergency Fund
VRS	Variable Return to Scale
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Term	Definition
Technical efficiency	This term referred to the capability of a given Universal Secondary Education school to utilize all its inputs, and fully translate into outputs. In this study, technical efficiency was deemed as such, for a given school, it is was at 100%, following data envelopment analysis.
Inputs	This term referred to all resources that a school uses to function on a day-to-day basis, distinctively or compositely. In this study the inputs assessed included school student enrolment, Number of classrooms, Mean amount of money spent to run the school per year, Number of teachers (Staffing), Student teacher ratio, Teacher quality, Quality of students admitted into Senior one, PTA contribution to teachers.
Output	This term referred to the performance index of a given U.S.E school in Uganda national Examinations at Uganda Certificate of Education level, over a three-year period.
Factors influencing	This phrase was used to refer to three categories

technical efficiency of characteristics that had statistically significant influences on technical efficiency of U.S.E schools. They included intrapersonal, institutional and systemic characteristics. But for the scope of this study, the systemic factors were recommended for future researchers.

Intrapersonal characteristics This term referred to the socio-demographic, personal trait characteristics of head teachers, that were found to have statistically significant influences on technical efficiency of U.S.E schools.

Institutional characteristics This term referred to the internal characteristics of U.S.E schools, that were found to have statistically significant influences on technical efficiency of U.S.E schools.

ABSTRACT

This research investigated the factors affecting technical efficiency in Universal Secondary Schools (USE) in Western Uganda. As the government increases investments in the public sector to enhance social service delivery, the USE policy has significantly improved accessibility to secondary education, promoted equity, reduced inequality, and empowered girls. However, concerns about the quality of educational outputs, particularly in the Uganda Certificate of Education (UCE) results, threaten the policy's objective of developing essential human capital for national growth.

By applying a systems theory framework—viewing schools as interconnected systems—and efficiency theory, which emphasizes maximizing outputs from inputs, this study aims to determine the proportion of technically efficient USE schools, identify intrapersonal factors influencing technical efficiency, and assess institutional factors affecting efficiency levels.

Utilising a pragmatic philosophy and an explanatory sequential mixed-methods approach, data were collected through surveys and interviews across four sub-regions in Western Uganda, targeting 275 USE schools for quantitative data and interviewing 20 headteachers and 15 external education officers. Data Envelopment Analysis (DEA) in STATA quantified efficiency levels, while log-binomial regression in SPSS analyzed the factors affecting technical efficiency. Thematic analysis was employed for qualitative data.

Findings reveal that 65% of USE schools in Western Uganda are technically efficient at variable returns to scale (VRS), with a mean technical efficiency of 0.960. However, 35% exhibited decreasing returns to scale (DRS), resulting in approximately 15,000 students missing out on the four-year sponsored UCE, highlighting inefficiencies and confusion among stakeholders.

Significant intrapersonal factors affecting technical efficiency include the setting of strategic goals (P-value=0.019), informal staff conversations (P-value=0.012), and program monitoring (P-value=0.045). Institutional factors, such as the use of electricity (P-value=0.041) and budgetary allocations, were also significant.

The study provides quantitative and qualitative recommendations for school managers and policymakers to optimize resource utilization and enhance systemic functionality in USE schools. Quantitative measures include a School Resource Optimization Model (SROM), an integrated quantitative and qualitative linear programming model, and a benchmarking framework. Qualitative recommendations emphasize continuous capacity-building programs for school staff, strategic stakeholder engagement, and policy revisions from decentralized to centralized governance.

Key Terms: Technical efficiency, Data Envelopment Analysis (DEA), Universal Secondary Education, Uganda, Educational outcomes, Efficiency theory, Systems theory, intrapersonal factors, institutional factors, educational management, School Resource Optimization, integrated quantitative and qualitative linear programming, benchmarking, integrated school workers capacity building, strategic systemic stakeholder engagement, decentralized to centralized policy reviews

CHAPTER ONE:

INTRODUCTION

1.1 Introduction

With global attention focused on education due to its proven transformative effects on all aspects of development, more cost-efficient and effective approaches are being advocated as the world undergoes intense globalization, technological development, and economic transformation (World Trade Organization, 2023; International Monetary Fund, 2023). Additionally, current global challenges require more sophisticated solutions (UNESCO, 2024). Thus, the need for augmented investment in education has never been greater if sustainable development is to be achieved by 2030. This vision was established in the post-Millennium Development Goals (MDGs), with Sustainable Development Goal (SDG) 4 of the global development agenda dedicated to education. Goal 4, titled "Quality Education," aims to ensure inclusive and equitable quality education for all, along with lifelong learning opportunities (United Nations International Children's Emergency Fund [UNICEF], 2024). The inclusion of education among the top five goals of the global development agenda is supported by evidence that education (SDG 4) has transformative ripple effects on all the other 16 goals in the 2030 agenda (UNICEF, 2024; UNESCO, 2024). Education is a known precursor to peace, stability, economic development, and functional societies (Runde et al., 2023). The United Nations Educational, Scientific and Cultural Organization (UNESCO) demonstrated that if all people had access to education, world poverty could be halved (UNESCO, 2024). Previous evidence also indicates that education can lead to the elimination of global poverty (Granata, 2022; Fang et al., 2022; Chelli et

al., 2022; Gillian et al., 2021; Gong & Hong, 2021; Habibi & Zabardast, 2020). This implies that with education, Goal 1 (poverty reduction) can be achieved (Zapp, 2022; Samo, 2022). Furthermore, education has been linked to technological advancement (Bing, 2023; Özdoğan Özbal, 2021; OECD, 2022; Rowe, 2019; Sahnoun & Abdennadher, 2022) and improved health and well-being (Raghupathi & Raghupathi, 2020; Liu et al., 2023; Kagaigai et al., 2023; Fu et al., 2022), both of which are envisioned in various development goals. Thus, the potential contribution of education to global sustainable development is undisputed. Among the various levels of education, secondary education is particularly beneficial to development, as evidenced by Target 4.1 of Goal 4, which aims for all boys and girls to complete quality primary and secondary education by 2030 (UNICEF, 2024).

The importance of secondary education is rooted in the fact that it serves as a pathway to tertiary or post-secondary education at institutions, colleges, technical training organizations, and universities. Such institutions are also instrumental in perpetuating development, with their impact often exceeding that of secondary education (World Bank Group, 2024; UNESCO, 2024; Ainscow, 2020; Bamberger & Kim, 2022). Therefore, ensuring access to quality and equitable secondary education is crucial for any country that intends to develop. Consequently, many countries have implemented free secondary education policies (Stenzel et al., 2024; Mohammed & Kuyini, 2021; Gruijters et al., 2023; Blimpo, Gajigo, & Pugatch, 2019; Godda, 2018; Chanimbe & Dankwah, 2021). One such country is Uganda, which implemented the Universal Secondary Education policy in 2007 (Ministry of Education and Sports, 2020). However, as noted in the SDGs, such education policies should not only aim to make secondary education equitable but also ensure high quality. This quality aligns with schools achieving high output in

terms of student performance, implying that schools should be technically efficient.

1.2 Background to the study

1.2.1 Historical background

Organizational performance and organizational efficiency are significantly either positively or negatively related terms (Rubio-Picón et al., 2023; Mbau et al., 2023; Zhenjing et al., 2022; Handoyo et al., 2023; Tran, Vo, & Ntim, 2020; Robinson et al., 2020; Cylus et al., 2016). While the former focuses on the ability to achieve goals, the latter emphasizes the quantity of resources needed to achieve those goals. This implies that an efficient organization is one that performs highly, and a highly performing organization is also one that is efficient (Jesús & Marisa, 2020). Therefore, the history of efficiency aligns with the history of organizational performance management. Organizational performance management practices have been implemented to enhance performance since the beginning of the industrial revolution in the early 20th century (Gonsalves, 2023). During the 20th century, beginning in 1900, management scholars like Taylor (1911) developed scientific management practices focused on motivating and developing employee skills to augment both their productivity and that of the organizations they work for. However, beyond the focus on managing human resources to enhance organizational performance, attention shifted to managing both human and non-human resources to achieve high performance with minimal resource wastage. This shift stemmed from the industrial revolution during the late 19th and early 20th centuries, when the rational use of scarce resources became paramount (Alexander, 2009). Institutional managers and administrators emphasized

rationality, control, and planning in all resources used in industrial processes. This focus also led to an emphasis on the laws of supply and demand to achieve market equilibrium (Jesús & Marisa, 2020), thereby promoting macro-level efficiency.

Throughout the period from 1900 to 1950, institutions attempted to ensure that they used as little input (resources) as possible while obtaining as much output as possible. At that time, institutions were striving for efficiency, although the term "technical efficiency" had not yet been coined. It was in 1951 that Koopmans, in his analysis of firm production, first used the term "technical efficiency." He asserted that technical efficiency could only be achieved by an organization that had a feasible combination of inputs and outputs. Building on Koopmans's assertions, Farrell (1957) developed the term "allocative efficiency," also known as price efficiency, which refers to using the cheapest inputs to produce the highest level of outputs (Jesús & Marisa, 2020). Since then, various scholars have contributed to the further development of technical efficiency and its understanding (e.g., Seitz, 1970; Afriat, 1972).

In the 1970s, measurement techniques for technical efficiency were developed, first by Charnes, Cooper, and Rhodes (1978), who suggested that linear programming techniques could be used to measure the efficiency of a given decision-making unit (DMU), each of which could have an envelope of efficient observations constructed. From Charnes, Cooper, and Rhodes (1978), the Data Envelopment Analysis (DEA) approach was developed. In 1981, they further expanded the DEA framework to include a factor-product orientation, or an input-output orientation (Charnes, Cooper, & Rhodes, 1981). Banker and Morey (1985,

1986) later demonstrated that the DEA framework could only adequately operate with the same orientation, and since then, DEA has become the most widely used approach in assessing technical efficiency.

While the measurement of efficiency and technical efficiency has its roots in the industrial sector, it has gradually been adopted in other sectors where efficiency is of paramount importance. Two of these sectors include health (Akazili et al., 2008; Varabyova & Schreyögg, 2013; Chowdhury et al., 2010; Gannon, 2005; Alhassan et al., 2015) and education (Lauro & Dos Santos Figueiredo, 2016; Drebee & Razak, 2018; Hussain et al., 2015; Johnes & Virmani, 2020; Johnson & Ruggiero, 2014; Gerard & Jee-Peng, 2001).

1.2.2 Theoretical background

Numerous theories have been developed over the past 50 years to provide constructs that can predict technical efficiency and organizational performance. These theories include the socio-cognitive theory (Bandura, 1986), the structural contingency theory (Pennings, 1992), the theory of organizational performance, the resource-based view theory (Barney, 1996), contingency theory (Fiedler, 1993), the resource acquisition model, classical organizational theory (Shafritz & Ott, 1992), human capital theory (Gary, 1964), decision-making theory (Edwards, 1954), systems theory (von Bertalanffy, 1968), and human relations theory (Nicotera, 2019), among others. While the commonality among these organizational performance theories is that they provide constructs for predicting organizational performance and efficiency, only a few explicitly address the interplay between inputs and outputs in a given system. For instance, the production function theory

(PFT) and the cost function theory (CFT) are commonly used to predict economic functions, determining how inputs are efficiently used to produce outputs in relation to the production possibility frontier (PPF). The PFT guides resource allocations and operational decisions (Koutsoyiannis, 1997; Caves & Christensen, 1980). However, these theories fail to integrate the dynamic interactions within the educational system, such as school culture, leadership styles, and community engagement, which systems theory captures to understand and improve the technical efficiency of schools (Hanushek, 1986). The CFT primarily aims to minimize costs in analyzing the technical efficiency of operations, focusing on measured output. It stipulates that when minimal costs are used and maximum output is realized, technical efficiency is high, as inefficiencies in cost management affect output (Afonso & Fernandes, 2008; Berger & Mester, 1997). While this theory has been widely applied in manufacturing and banking sectors (Afonso & Fernandes, 2008), it has also been used in education cost functions.

The benchmarking theory, on the other hand, stipulates that best practices from other organizations (schools) are observed and borrowed to improve operations. Under this theory, organizations are held to a set standard to contextualize best practices, and areas identified as underperforming are improved in proportion to the context (Camp, 1989; Spendolini, 1992). However, it does not consider systemic issues.

1.2.3 Conceptual background

Efficiency refers to the extent to which the objectives of a given organization or system are achieved relative to the resources input into achieving those objectives (Farrell, 1957). According to Farrell (1957) and Debreu (1951), there are two types of efficiency: allocative and technical efficiency. Technical efficiency focuses on maximizing outputs while minimizing inputs (Coelli et al., 2005; Kumbhaker & Lovell, 2000). Rathnayake and Amarathunge (2014) offer a similar definition, describing technical efficiency as the capacity of a decision-making unit (DMU) to produce as much output as possible with minimal input and waste.

In a systems context, inputs refer to all resources required to produce a given output. Bekaroglu and Heffley (2018) and de Cos et al. (2014) define inputs as resources necessary for the production function of the health system. These inputs are considered to be fully under the control of managers and leaders of a given DMU (Varela & de Andrade Martins, 2011). Allocative efficiency (AE), on the other hand, refers to maximizing outputs for the minimum cost of inputs. Together, technical and allocative efficiency comprise the overall efficiency of any system (Coelli et al., 2005; Mbau et al., 2023). However, technical efficiency is often more commonly used to denote the efficiency of a system or institution, as it indicates how resources are utilized to produce optimal benefits. An organization that uses minimal input to produce maximum output is said to be 100% technically efficient, or operating at best practice. Conversely, an organization operating below 100% is considered to have decreasing returns to scale (DRS). DRS is one of the model assumptions used to measure technical efficiency.

Initially, two model assumptions were developed to measure efficiency using the Data Envelopment Analysis (DEA) approach. The first is constant returns to scale (CRS), which occurs when the number of inputs directly corresponds to the number of outputs (Lamesgen et al., 2024). CRS was later extended to variable returns to scale (VRS), applicable when DMUs operate at varying levels of inputs (Coelli, 1996; Jacobs & Smith, 2006).

The VRS can manifest in two forms: decreasing returns to scale (DRS) and increasing returns to scale (IRS). DRS occurs when a DMU increases inputs but achieves lower outputs than expected. In this case, the DMU can only become efficient by decreasing its scale of operation (Lamesgen et al., 2024). Conversely, a DMU with IRS increases its inputs and achieves outputs that significantly exceed expectations. For such a DMU, becoming technically efficient requires an increase in the scale of operation (Steering Committee for the Review of Commonwealth/State Service Provision, 1997).

Technical efficiency, in all its conceptualizations, is closely related to outputs. Low outputs can have numerous negative consequences, particularly in secondary schools, especially Universal Secondary Education (U.S.E.) schools, which aim to increase access to education and have high enrollment numbers. Low output in U.S.E. schools can lead to significant national implications. For instance, poor performance at the ordinary level may prevent some students from obtaining sufficient grades to advance to higher education or vocational training. Consequently, many former U.S.E. beneficiaries may miss out on tertiary education, depriving the country of the economic benefits associated with it.

Tertiary education is linked to poverty reduction (Fang et al., 2022; Chelli et al., 2022; Garritzmann, 2016), increased national prosperity (World Bank Group, 2024), higher employability, and higher incomes (World Bank Group, 2024). It is also associated with technological and social development (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2024; Bing, 2023; Özdoğan Özbal, 2021; OECD, 2022; Rowe, 2019; Sahnoun & Abdennadher, 2022).

For a country like Uganda, which is classified as a low- to middle-income country (LMIC), low output in U.S.E. schools could further aggravate its economic potential and hinder its position on the global economic scale. This situation could worsen if the government reduces or eliminates capitation grants to U.S.E. schools in response to their low technical efficiency, leading to reduced access to secondary education and lower national literacy levels.

While few assessments of technical efficiency in secondary schools have been conducted globally over the past decade, available assessments indicate that many secondary schools are technically inefficient (Baba et al., 2021). For instance, in Tunisia, up to 96.5% of secondary schools were reported as inefficient (Yahia & Essid, 2019). Similar results may be true for secondary schools across Africa, but technical efficiency assessments are rarely conducted on the continent.

1.2.4 Contextual background

A critical review of the literature on technical efficiency across various sectors—public and private, including health, business, energy, and education—provides a useful trajectory for positioning this study within Universal Secondary Schools in Western Uganda. Hollingsworth (2003) studied technical efficiency in the health sector and noted significant variability in efficiency among hospitals. He

recommended that hospitals adopt a benchmarking model to enable inefficient ones to improve service delivery. Similarly, Kuo and Weng (2012) found that private hospitals were more efficient than public ones, suggesting that public hospitals should adopt competitive and transparent methods in service delivery. In the business sector, Fare and Pritmont (1995) conducted a technical efficiency analysis of various businesses and identified several factors affecting efficiency, leading to variations in profitability. They attributed these differences to the diverse strategies and operational processes employed by businesses. In contrast, Caves and Christensen (1980) found that economies of scale were key determinants of technical efficiency, urging firms to focus on the scale and scope of their operations for optimal output. In the energy sector, Koutsoyiannis (1977) demonstrated that technical efficiency analysis is beneficial, as it improves input quality and reduces unit operating costs while optimizing outputs. In education, the pioneers of technical efficiency studies—Charnes, Cooper, and Rhodes (1978)—identified inefficiencies in resource allocation in educational settings based on aggregated national data from several countries. They advocated for continuous monitoring using Data Envelopment Analysis (DEA) to drive improvements. Afonso and Fernandes (2008) conducted nationwide studies of public schools and found that efficiency variability was marginal, although outputs were more aligned with decreasing returns to scale (DRS). They recommended institutional studies focusing on the managerial operations of schools.

These studies reveal that scholars of technical efficiency across different sectors focus on distinct goals: educationists emphasize resource misallocations and optimality deficiencies, while health sector researchers aim at improving service delivery, and those in business and industry concentrate on profitability and

competitiveness. Despite these differences, a commonality exists: researchers across sectors utilize Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) as methodologies for determining technical efficiency to improve performance. Education scholars have favored DEA for its robustness in guiding benchmarking strategies. A key finding across these studies is the recommendation for policy reforms, improvements in management processes, and the adoption of customized technology.

This study builds on the work of Afonso and Fernandes (2008), focusing on resource allocation, decreasing returns to scale, and institutional studies. It aims to analyze public-funded Universal Secondary Schools in Western Uganda (Equal Opportunities Commission [EOC], 2004) to understand the challenges these schools face under the unified policy of Universal Education and to explore ways to optimize resources to enhance learners' outcomes in national assessment examinations. Focusing on Western Uganda—a developing region that charges the highest tuition fees for schools intended to be free—this study takes an individualized approach rather than a macro perspective. This approach allows for a detailed investigation into the experiences of individual schools and the potential of headteachers to utilize available resources effectively. This focus is especially urgent as Uganda seeks policies to reduce costs and improve public service delivery through enhanced management practices and educational outcomes across all U.S.E. schools.

1.3 Problem statement

For over a decade, Universal Secondary Education (U.S.E.) schools have been operational in Western Uganda, yet many exhibit characteristics typical of

decision-making units with constant or decreasing returns to scale, leading to significant technical efficiency gaps. Notably, there is a lack of explicit documentation on the level of technical efficiency among U.S.E. schools in this region, making it impossible to quantify the extent of the problem. Consequently, no reliable metrics exist to highlight the magnitude of low technical efficiency within these schools.

Given that technical efficiency results from the interplay between inputs and outputs, current outputs, such as Uganda Certificate of Education (U.C.E.) performance, can be compared to the inputs available to these schools. For example, among the best-performing schools in the U.C.E. exams, less than 20% are located in Western Uganda, with even fewer being classified as U.S.E. schools. In 2020, top-performing schools were concentrated in only 38% of the districts in the region, with only two of those being U.S.E. schools. This pattern suggests that the outputs of U.S.E. schools are considerably suboptimal.

Despite the Ugandan government's commitment to providing capitation grants to U.S.E. schools since 2007, substantial funding has not translated into improved performance. In 2020, these schools received approximately 90 billion Ugandan shillings, which was intended to facilitate quality education and support high performance in U.C.E. exams. By 2022, the capitation reached over 100 billion shillings. Furthermore, many U.S.E. schools maintain high entry standards, have fully staffed teaching positions, and active Parent-Teacher Associations (PTAs), yet they still struggle to achieve optimal performance levels.

It can be asserted that U.S.E. schools in Western Uganda possess the necessary inputs to facilitate optimal U.C.E. performance. However, some schools exhibit

constant returns to scale (CRS), decreasing returns to scale (DRS), or increasing returns to scale (IRS), indicating gaps in technical efficiency. Despite the known challenges, no assessments of technical efficiency using Data Envelopment Analysis (DEA) have been conducted in these schools. This lack of quantification means that the actual level of technical efficiency among U.S.E. schools remains unknown.

Moreover, while various reports have addressed factors contributing to low outputs among U.S.E. schools, there has been no comprehensive regional assessment of the factors influencing technical efficiency. These knowledge gaps must be addressed; otherwise, the Ugandan government may respond to headteachers' demands for increased capitation grants without understanding the underlying issues, potentially leading to continued inefficiencies.

Thus, this study aims to assess the factors influencing technical efficiency in U.S.E. schools within Western Uganda, filling crucial knowledge gaps and providing insights necessary for policy reform and improved educational outcomes.

1.4 Objectives of the study

1.4.1 General Objective

To assess technical efficiency and its influencing factors in Universal Secondary Education (U.S.E.) schools in Western Uganda.

1.4.2 Specific Objectives

1. To determine the proportion of Universal Secondary Education (U.S.E.) schools in Western Uganda that is technically efficient.
2. To establish the intrapersonal factors influencing the level of technical efficiency in U.S.E. schools in Western Uganda.

3. To assess the institutional factors influencing the level of technical efficiency in U.S.E. schools in Western Uganda.

1.5 Hypotheses

Ha1: Intrapersonal factors influence the level of technical efficiency in public universal secondary schools within western Uganda

Ha2: The institutional factors influence the level of technical efficiency in public universal secondary schools within western Uganda.

1.6 Justification of the study.

The justification for this study stems from the critical need to address the gaps in technical efficiency within Universal Secondary Education (U.S.E.) schools in Western Uganda. Secondary education plays a pivotal role in national human capital development, which is essential for sustainable economic growth (Runde et al., 2023; UNESCO, 2024). Despite substantial government investment through capitation grants aimed at enhancing educational access and quality, the lack of improvement in Uganda Certificate of Education (U.C.E.) outcomes raises concerns about resource allocation and efficiency among U.S.E. schools.

This study is particularly timely given the ongoing debates regarding educational funding and performance. Stakeholders, including parents and government officials, have expressed frustrations over perceived inefficiencies in the education system, which necessitates a thorough investigation into the factors influencing technical efficiency. Understanding these factors is crucial for informing policy decisions and ensuring that resources are utilized effectively to enhance educational outcomes.

Furthermore, while existing research on technical efficiency has predominantly focused on the health sector (Ayiko et al., 2020; Nabyonga-Orem et al., 2023), there remains a significant gap in the literature regarding secondary education. Prior assessments have largely overlooked the specific challenges faced by U.S.E. schools, particularly in Western Uganda. By focusing on this underexplored area, the study aims to contribute valuable insights that can inform educational policy and practice.

In addition, the findings of this research will provide a basis for future studies, enabling a deeper understanding of the complexities surrounding technical efficiency in educational settings. This could ultimately lead to the development of targeted interventions and reforms that improve the overall performance of U.S.E. schools, thereby enhancing the educational landscape in Uganda.

By addressing these critical issues, this study not only aims to fill existing knowledge gaps but also seeks to promote a more efficient and effective educational system that can better serve the needs of students and the broader community. Secondary education underpins national and future human capital development, which is central to the Universal Secondary Education (U.S.E.) policy. Rising capitation grants have not translated into stronger Uganda Certificate of Education (U.C.E.) outcomes, indicating potential resource wastage.

While studies on technical efficiency at the primary level exist, there is a noticeable lack of systematic efficiency studies within U.S.E. schools. It is crucial to determine whether underperformance stems from resource shortfalls or internal inefficiencies to inform policy. The blame-shifting and resource demands for better

educational outcomes have sparked significant outcry from parents and the government.

Education is an undisputed promoter of sustainable development; without it, no country can achieve its developmental goals (Runde et al., 2023; UNESCO, 2024). Although all education levels contribute to knowledge acquisition, secondary education is arguably the most critical stage. Consequently, many countries have made significant efforts to ensure increased access to secondary education, even making it free for all. In Uganda, the government introduced the U.S.E. model to enhance access to secondary-level education (Ministry of Education and Sports, 2020). The government provides regular capitation grants to each U.S.E. school and has gradually increased these grants to bolster educational funding. However, the anticipated increase in outputs per U.S.E. school has not materialized, particularly in Western Uganda (Huylebroeck & Titeca, 2015).

It is possible that U.S.E. schools in the Western region have gaps in technical efficiency, hindering their ability to convert inputs, including capitation grants, into outputs without wastage. Alarming, the assessment of technical efficiency in U.S.E. schools and its influencing factors has not received adequate attention from the scholarly community in Uganda. Although some assessments have been conducted, such as those by Muvawala and Hisali (2012), they focused on primary education rather than secondary.

Globally, the technical efficiency of secondary schools remains underexplored. Most studies have concentrated on the health sector (Ayiko et al., 2020; Nabyonga-Orem et al., 2023; Lamesgen et al., 2024; Zhao et al., 2023; Babalola & Moodley, 2020; Mbau et al., 2023; Ngobeni et al., 2020; Li et al., 2021; Novignon &

Lawanson, 2014; Ahmed et al., 2019; Moreno-Serra et al., 2019; Zarulli et al., 2021), with fewer focused on education (e.g., Nguemkap & Tchoffo, 2022; Margaritis et al., 2022; Provazníková & Chlebounová, 2018; Chlebounová, 2019). Although U.S.E. schools have been studied in various contexts (Kakuba et al., 2021; Huylebroeck & Titeca, 2015), these assessments have primarily focused on performance rather than technical efficiency. Over the past decade, ongoing complaints about the efficiency of U.S.E. schools in Uganda should have triggered interest in their assessment.

In other countries, including Greece, the United States, Malaysia, Pakistan, Mauritius, and Switzerland, research has extensively addressed the technical efficiency of secondary schools (Sotiriadis et al., 2018; Baba et al., 2021; Horrace et al., 2022; Nauzeer et al., 2018; Johnes & Virmani, 2020; Huguenin, 2015; Horrace, Rothbart, & Yang, 2022). Therefore, the research gap concerning school technical efficiency and its influencing factors is evident in Uganda, particularly in Western Uganda, which justifies the need for this study.

1.7 Significance of the study

The findings of this study may hold significant programmatic and policy implications, particularly given the repeated calls for the government of Uganda to increase capitation grants for Universal Secondary Education (U.S.E.) schools. These calls are based on the premise that current grants are insufficient for maximizing outputs in beneficiary schools. With the insights gained from this research, the Ministry of Education and Sports will be able to determine whether the gaps in output among U.S.E. schools are solely due to low capitation grants or if they stem from technical efficiency issues within the schools.

Additionally, the Ministry will be positioned to intervene effectively in enhancing technical efficiencies at U.S.E. schools, utilizing the evidence obtained regarding institutional and systemic factors influencing technical efficiency. This evidence will enable targeted interventions at both levels of influence.

At the district level, District Education Officers (DEOs) will also benefit from this study. By policy, DEOs are mandated to oversee the education sectors within their jurisdictions and ensure that all schools provide the highest quality education possible. The findings will help DEOs assess the efficiency of U.S.E. schools in their districts and identify the reasons behind any inefficiencies. Consequently, they will be able to formulate locally tailored, evidence-based policies and programs aimed at improving school efficiency, even with the current levels of capitation received. In the long run, increased technical efficiency may prompt the government to consider raising capitation grants, based on the expectation that this will further enhance efficiency in already performing schools. By computing the technical efficiency of all U.S.E. schools in the Western region, this study will provide insights into how effectively these schools utilize their inputs, including capitation grants. Head teachers will be able to implement necessary administrative modifications to augment efficiency, thereby improving overall school performance. This will be facilitated by the study's analysis of the factors influencing technical efficiency, enabling head teachers to identify and make evidence-based interventions tailored to enhance performance.

For academia, this study will be significant for scholars in the fields of education management and other sectors, as it represents one of the first assessments of the technical efficiency of U.S.E. schools since their inception in Uganda. Thus, the

study will serve as a valuable source of in-country literature on technical efficiency and its influencing factors. Moreover, it may inspire further assessments of technical efficiency in U.S.E. schools across other regions in Uganda or in similar contexts worldwide. The significance of this study lies in its potential to contribute to various dimensions of educational policy, practice, and research in Uganda, particularly within the context of Universal Secondary Education (U.S.E.) schools in Western Uganda.

This research will provide policymakers with empirical data on the technical efficiency of U.S.E. schools, highlighting areas where resource allocation may be optimized. By identifying the factors influencing technical efficiency, the study will inform strategic decisions aimed at enhancing educational outcomes. This could lead to more effective use of capitation grants and other resources, ultimately improving the quality of education provided to students.

The findings will serve as a valuable resource for school administrators and educators seeking to enhance their institutions' performance. By understanding the internal and external factors affecting technical efficiency, schools can implement targeted interventions to improve resource management, teaching practices, and student outcomes. This is particularly crucial in a context where educational resources are limited and must be utilized effectively.

This study will fill a significant gap in the existing literature regarding technical efficiency in secondary education, particularly in Uganda. By employing methodologies such as Data Envelopment Analysis (DEA), the research will contribute to theoretical frameworks and models that can be adapted for future studies in educational efficiency. This contribution will enhance the academic

discourse surrounding educational management and efficiency, both locally and globally.

Improved technical efficiency in U.S.E. schools can lead to better educational outcomes, which in turn can enhance employability and economic prospects for graduates. This aligns with national goals for human capital development and economic growth. By fostering a more skilled workforce, the study will indirectly contribute to the overall socio-economic development of Uganda.

The insights gained from this study will pave the way for further research in the field of educational efficiency. Future studies can build on the findings to explore additional variables and contexts, thereby expanding the understanding of how technical efficiency impacts educational systems across different regions and countries.

1.8 Scope of the study

1.8.1 Geographical Scope

This study was conducted in Western Uganda, one of the four administrative regions of the country, alongside Northern, Eastern, and Central Uganda. The Western region has a population of approximately 6,417,449 people, distributed across 35 districts, including Kasese, Buliisa, Kyegegwa, Hoima, Ibanda, Kabale, Ntoroko, Kabarole, Kamwenge, Kanungu, Bundibugyo, Kibaale, Kiruhura, Kisoro, Buhweju, Kyenjojo, Masindi, Mbarara, Mitooma, Ntungamo, Rubanda, Bushenyi, Kiryandongo, Isingiro, Rubirizi, Rukungiri, Bunyangabu, Sheema, and Rukiga. These districts are further categorized into four subregions: Ankole, Tooro/Rwenzori, Kigezi, and Bunyoro.

The selection of this region as the study area is based on the fact that it hosts over a third (n = 371, 42%) of all Universal Secondary Education (U.S.E.) schools in Uganda (n = 916), all of which receive capitation grants. However, the output in terms of performance at the Uganda Certificate of Education (U.C.E.) level does not appear to correspond with the inputs provided to these schools. Therefore, assessing the technical efficiency of U.S.E. schools in this region, along with the influencing factors, is critical. The findings could potentially reflect the technical efficiency situation in other regions of the country. The study involved meticulously selected U.S.E. schools distributed across the four subregions.

1.8.2 Content scope

This study was delimited to assessing the technical efficiency of U.S.E schools in western Uganda, and their influencing factors. Technical efficiency was the outcome (dependent) variable of the study, that was assessed using data enveloping analysis (DEA) approach. With the DEA approach, input and output data for each secondary school (a decision-making unit) was obtained and analyzed in order to determine the return to scale of each school (Lamesgen et al., 2024; Mehdiloo and Podinovski et al., 2024; Dobos and Vörösmarty, 2024; Cooper et al., 2007; Nemati et al., 2020). This was done to determine whether there was a balance between the inputs of each school, and their outputs, given that in an education system, inputs are supposed to translate into outputs, of which the outputs ought not to be lower than the input, if the system is to be technically efficient. The outputs that were considered in the assessment were limited to those in a typical U.S.E school setting. They included; student enrolment, Number of classrooms, Mean amount of money spent to run the school per year, Number of

teachers (Staffing), Student teacher ratio, Teacher quality, Quality of students admitted into Senior one, and PTA contribution to teachers.

The output that was measured was student performance, given that performance is the sole output that each school ought to achieve, as its key indicator of organizational performance (Araújo et al., 2019; Burusic et al., 2016; Luyten et al., 2005; Burroughs et al., 2019; Aquino et al., 2021). However, the academic performance of each school was limited to performance at the level of the Uganda Certificate of Education (U.C.E), given that is the only level of education supported by the U.S.E capitation grant. Performance at U.C.E exams was indicated by number of first grades obtained by school, given that first grade achievement at Ordinal level (O-Level) is considered to be the epitome of success at that level, and an indicators of a high performing school in Uganda (Mitana et al., 2021).

It should be noted that technical efficiency of any decision-making unit (DMU) can be measured using two DEA models, one being the constant returns to scale (CRS), and the variable returns to scale (VRS), of which the latter is considered to be most appropriate when the DMUs have different input sizes (operating scales) (Coelli, 1996; Jacobs and Smith, 2006). The schools that were targeted had variant operational scales, in terms of student enrolment, Number of classrooms, Mean amount of money spent to run the school per year, Number of teachers (Staffing), Student teacher ratio, Teacher quality, Quality of students admitted into Senior one, and PTA contribution to teachers, which implied that the VRS was suitable for measuring technical efficiency. A given U.S.E school was considered to be technically efficient when its technical efficiency score was found to be 1.

Besides assessing technical efficiency as the dependent variable, this study also had exposure variables, which were two in number, including intrapersonal and institutional factors. The intrapersonal factors referred to the socio-demographic, personal trait characteristics of head teachers, that were found to have statistically significant influences on technical efficiency of U.S.E schools. The institutional factors referred to the internal characteristics of U.S.E schools, that were found to have statistically significant influences on technical efficiency of U.S.E schools. The two exposure variables were informed by the systems theory (von Bertalanffy, 1968) and also by evidence from previous studies that have assessed the factors influencing technical efficiency (Ayiko et al., 2020; Nabyonga-Orem et al., 2023; Lamesgen et al., 2024; Baba et al., 2021; Huguenin, 2015; Li et al., 2021)

1.8.3 Time scope.

This study considered three time-related factors. First, it was conducted between March and August 2022. The assessment of technical efficiency was based on inputs and outputs utilized by the schools over the previous three years, specifically 2017, 2018, and 2019. This three-year period was chosen because it provides a sufficient timeframe to establish an accurate and valid trend of events for each decision-making unit (DMU). Using data from only one year could misrepresent patterns of inputs and outputs, as it may reflect a one-off situation that does not capture habitual practices. While two years would yield some insight into trends, they might only partially reveal consistent practices. In contrast, a three-year period provides three distinct data points for assessing inputs and outputs per DMU, thereby offering a more valid representation of habitual practices and

performance. Additionally, it was impractical to include data from 2020 and 2021 in the assessment of technical efficiency due to the disruptions caused by the COVID-19 pandemic. During this period, schools were significantly affected, with teachers unable to adequately instruct O-level students and schools not utilizing their resources (inputs) as they normally would. Including this data would likely bias the findings and lead to an underestimation of technical efficiency. The second time consideration was that the study included only head teachers who had held their positions throughout the entire assessment period (2018, 2019, and 2021). This criterion was essential to ensure that the findings were associated with the leadership in place during the assessment period.

1.8.4 Thematic Focus

The research concentrated on two main themes: (a) the measurement of technical efficiency using Data Envelopment Analysis (DEA) and (b) the identification of intrapersonal and institutional factors influencing efficiency. By focusing on these themes, the study aimed to provide actionable insights that could inform policy and practice within the educational sector.

1.8.5. Limitations

While the study aims to provide a comprehensive assessment of technical efficiency, it is essential to acknowledge potential limitations. These may include challenges in data collection, such as the availability of accurate records from schools and the willingness of participants to engage in the study. Additionally, the findings may be context-specific and may not be generalizable to U.S.E. schools in other regions or countries.

1.9 Conceptual framework

Figure 1 below illustrates the conceptual framework of this study, which identifies two independent variables: intrapersonal and institutional characteristics. The selection of these variables is grounded in systems theory and supported by evidence from previous studies that have identified factors influencing technical efficiency at these two levels.

The two independent variables are conceptualized as potentially impacting the technical efficiency of the decision-making units (DMUs). Technical efficiency serves as the dependent variable in this study, represented by a Variable Returns to Scale (VRS) score of 1, indicating 100% technical efficiency. According to systems theory, technical efficiency is understood to be influenced by a combination of inputs, including:

- I. School student enrollment
- II. Number of classrooms
- III. Mean amount of money spent to run the school per year
- IV. Number of teachers
- V. Student-teacher ratio
- VI. Teacher quality
- VII. Quality of students admitted into Senior One
- VIII. Parent-Teacher Association (PTA) contributions to teachers

The output is measured by performance at the Uganda Certificate of Education (U.C.E.) exams, specifically indicated by the number of first grades obtained by each school.

Furthermore, the framework illustrates that the relationship between inputs and outputs within a given education system (a decision-making unit) is mediated by several processes, including

- I. Administration
- II. Staff development practices
- III. Resource management
- IV. Budgeting
- V. Staff performance

These processes are treated as covariates in this study, highlighting their role in influencing the overall technical efficiency of the U.S.E. schools

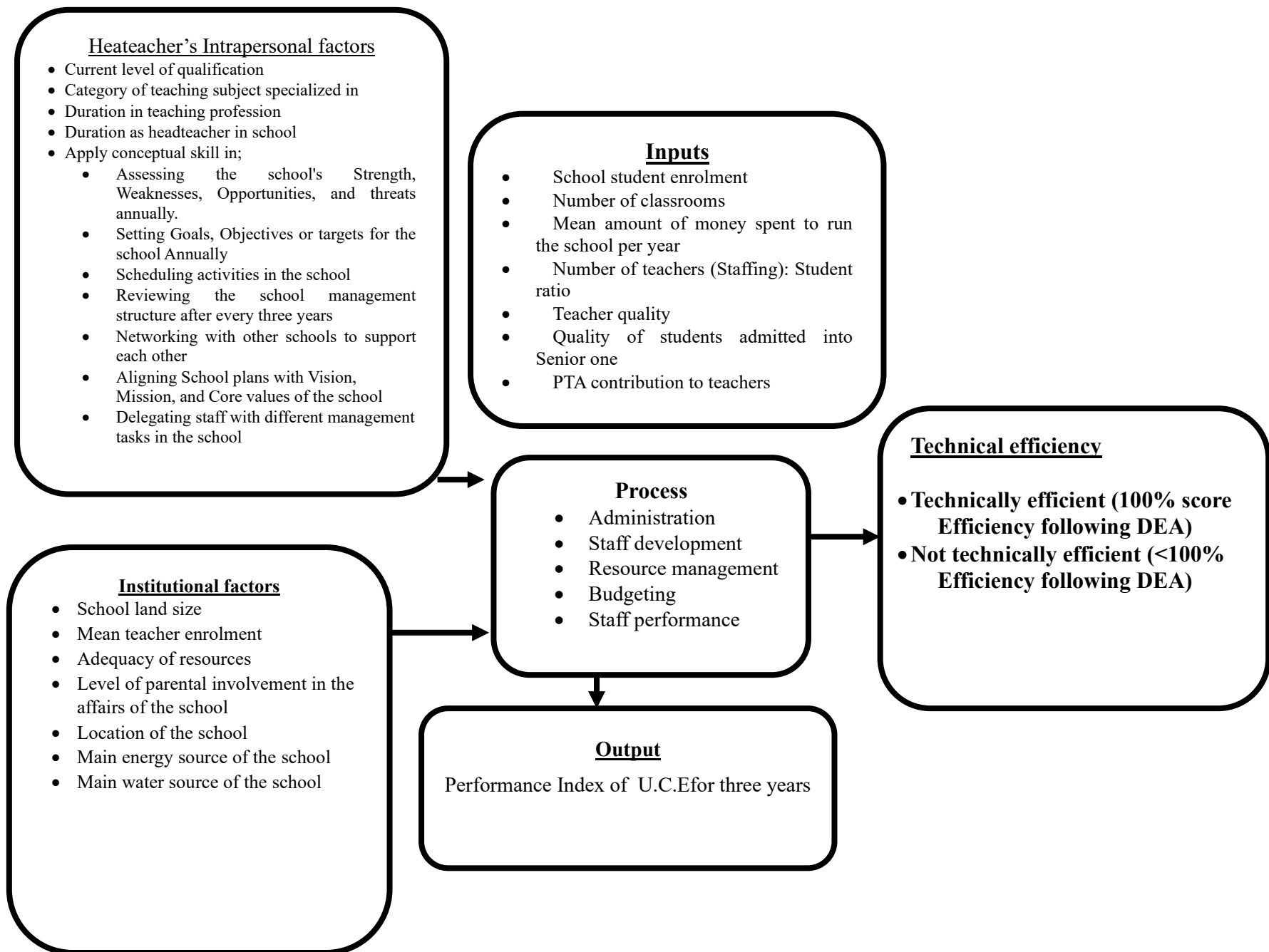


Figure 1: Conceptual framework adapted from the systems theory

CHAPTER TWO

LITERATURE REVIEW.

This chapter presents a review of the literature relevant to the study, specifically addressing its three objectives. The section is organized into three parts: the first part (2.1) covers literature related to the level of technical efficiency in secondary schools; the second part (2.2) addresses intrapersonal factors associated with technical efficiency; and the third part (2.3) explores institutional factors influencing technical efficiency. The literature reviewed was obtained from studies accessed through databases including PubMed, Google Scholar, SpringerLink, ScienceDirect, and EMBASE. The targeted studies were those published between 2014 and 2024.

2.1 The Level of Technical Efficiency in Universal Secondary Schools

The assessment of technical efficiency in secondary schools has garnered interest from various scholars for decades. Numerous studies have been conducted to determine whether the resources allocated to secondary schools result in the desired quality of performance, especially in light of the increasing demand for more resource inputs without adequately addressing the levels of wastage (slackness) in input and output variables.

However, most assessments of technical efficiency have been conducted in the Global North, predominantly utilizing quantitative approaches and analyzing institutions as isolated decision-making units (DMUs), neglecting the systems theory that incorporates both qualitative and quantitative methods to assess holistic institutional performance (Ifigenia-Dimitra & Stylianos, 2021; Sotiriadis et al., 2018; Provazníková & Chlebounová, 2018; Chlebounová, 2019; Margaritis et al.,

2022; Andersson & Sund, 2021). A multi-country study by Ifigeneia-Dimitra and Stylianos (2021) across several European nations revealed that secondary schools in Estonia, Greece, Slovakia, Ireland, and Belgium were perfectly efficient. In contrast, schools in other European countries, including Malta, the United Kingdom, the Netherlands, and others, were found to be technically inefficient. The authors noted that Malta had the lowest efficiency, while Greece and Estonia ranked second and first, respectively. The mean level of technical efficiency among the schools in Europe was reported at 0.933, with a standard deviation of 0.054. This indicates that technical efficiency among secondary schools is not universal, with inefficiencies reaching as high as 7%.

However, it is important to note that only the mean technical efficiency was reported, without specifying the proportion of secondary schools that achieved technical efficiency. In Greece, Sotiriadis et al. (2018) conducted a study to examine the technical efficiency of secondary schools in Central Macedonia. Utilizing Data Envelopment Analysis (DEA) with Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS), the findings indicated that the majority of schools were technically inefficient, with CRS efficiency at 0.827 and VRS efficiency at 0.834.

Similar to the study by Ifigeneia-Dimitra and Stylianos (2021), only the mean technical efficiency was reported, which limited the authors' ability to assess factors associated with technical efficiency due to the lack of a binary outcome. Another Greek study by Margaritis et al. (2022) examined the technical efficiency of upper secondary schools in Central Greece from 2015 to 2018. The results indicated that most schools were inefficient, with CRS efficiency ranging

from 0.64 to 1.000 and VRS efficiency from 0.78 to 1.000. Although the mean levels of technical efficiency were reported as 0.852 (CRS) and 0.936 (VRS), this does not reflect the proportion of schools that achieved a technical efficiency of 1.000.

In the Czech Republic, Provazníková and Chlebounová (2018) evaluated the technical efficiency of vocational secondary schools in the Pardubice region. Their findings revealed that only five out of 20 schools were efficiently utilizing their resources. The inputs analyzed included expenditures on teacher salaries and the number of classrooms, while the output was simply the pupil population. This assessment failed to consider how well the pupils performed academically, which is a crucial indicator of school impact.

A subsequent study by Chlebounová (2019) in the Czech Republic assessed technical efficiency using DEA, focusing solely on the amount spent on teacher salaries as the input. The outputs were performance in English, math, and Czech language, revealing that only 12 of the 36 secondary schools (33%) were technically efficient. This narrow focus on a single input limited the robustness of the findings, suggesting that the overall technical efficiency could have been higher had multiple inputs been considered.

Higher levels of technical efficiency were reported in Sweden, where Andersson and Sund (2021) found that 89.9% of schools were technically efficient. This stands in stark contrast to findings in Indonesia, where Rohayana (2018) reported a technical efficiency level of only 32.4%, with a mean efficiency of 0.936.

In Switzerland, Huguenin (2015) assessed school technical efficiency and found a mean technical efficiency of 93%, noting that schools lost 7% of their inputs due to

inefficiencies. This level is comparable to findings in Mauritius, where Nauzeer et al. (2018) assessed 141 secondary schools, reporting a mean technical efficiency of 0.872 for both CRS and VRS. In Asia, Baba et al. (2021) investigated the technical efficiency of 626 secondary schools in Malaysia, reporting a technical efficiency level of 67%, which is lower than that observed in Tunisia.

Yahia and Essid (2019) used DEA to assess Tunisian secondary schools and reported a technical efficiency level of only 3.5%, indicating that 96.5% were inefficient, suggesting that schools could have improved their results by 27% using the same resources.

While numerous assessments of technical efficiency have been conducted in secondary schools, more studies have focused on the health sector, with additional research in the agricultural sector. In agriculture, Thapa et al. (2023) studied 223 Nepalese rice seed growers, finding a mean technical efficiency of 96.2%. Similarly, Subedi et al. (2020) reported a mean technical efficiency of 92% among Nepalese rice farmers using a one-step stochastic frontier approach. Chandio et al. (2019) reported a higher technical efficiency of 97% among rice farmers in Pakistan, although a subsequent study by Choudhary et al. (2022) found a technical efficiency of 75.2% among rice farmers in Nepal's Chitwan district.

High levels of technical efficiency have also been observed in the health sector. A global analysis by Zarulli et al. (2021) reported a technical efficiency level of 93% across 140 health systems, with European, Asian, and South American health systems achieving the highest efficiencies at 96%, 95%, and 95%, respectively. However, in East Asia, Cheng et al. (2015) reported technical efficiency levels of only 8.8% at CRS and 15.8% at VRS, significantly lower than the findings of Zarulli

et al. (2021), possibly due to differences in data recency and implemented interventions. In the Kingdom of Saudi Arabia (KSA), Alatawi et al. (2020) used non-parametric DEA to measure the technical efficiency of 91 public hospitals, reporting that 75.8% were technically inefficient. However, a later study by the same authors in the same year reported that 76% of public hospitals were technically efficient, an inconsistency that raises questions about the reliability of the findings. In another Middle Eastern study, Kakemam et al. (2019) reported a mean technical efficiency of 0.86 among public health facilities in Iran.

In Africa, technical efficiency remains variable. A systematic review by Nabyonga-Orem et al. (2023) found a mean technical efficiency of 0.77, indicating a 23% inefficiency gap. When using DEA at the health facility level, the efficiency dropped to 0.67, closely aligning with Jarjue et al. (2015), who reported a VRS technical efficiency of 64.8% among Gambian healthcare facilities. In West Africa, Babalola and Moodley (2020) reported that health systems were 40% efficient or less.

In South Africa, Ngobeni et al. (2020) found technical efficiency levels in public healthcare systems ranging from 35.7% to 87.2%, which matched the findings of Babalola et al. (2020) in their study of district hospitals in KwaZulu-Natal. Among the 38 hospitals studied, CRS efficiency was reported at 31.6% (2014/15), 42.1% (2015/16), and 36.8% (2016/17), while VRS efficiency stood at 57.9%, 50.0%, and 55.2% over the same period, indicating significant gaps in technical efficiency.

In Ethiopia, Lamesgen et al. (2024) found that only 59.3% of 27 health centers in Northwest Ethiopia were technically efficient. However, Ethiopia has demonstrated relatively high levels of technical efficiency, with Bobo et al. (2018) reporting CRS

technical efficiency at 77% and VRS technical efficiency at 94%. Amare et al. (2020) also reported a high technical efficiency of 0.92 for public hospitals in Northwest Ethiopia.

In Eastern Africa, technical efficiency has been reported to range from 41% to 69% in regional health systems (Babalola & Moodley, 2020), similar to findings by Ayiko et al. (2020), who reported a VRS technical efficiency of 69% among general hospitals in Uganda. Four years earlier, Mujasi et al. (2016) reported a VRS technical efficiency of 47% among referral hospitals in Uganda.

2.2 The intrapersonal factors influencing the level of technical efficiency in universal secondary schools.

According to systems theory, the likelihood that an input will translate into an output is influenced by the environment in which the system operates. In the context of an education system, part of this environment includes human resources, particularly teachers and their leaders. Among these, headteachers play a crucial role, as they are responsible for overseeing school operations, managing resources, and ensuring that their institutions achieve peak performance. Thus, the personal characteristics of headteachers are significant in propelling their respective institutions toward optimal performance. These personal characteristics can encompass a range of factors, including socio-demographic characteristics, personal traits, work experience, and leadership characteristics (Nyakundi & Munyao, 2022; Flanigan et al., 2017; Fujianti, 2018; Al Khajeh, 2018; Bhargavi & Yaseen, 2016; Chan et al., 2019; Nwokocha & Iheriohanma, 2015; Akparep et al., 2019; Otila & Kyongo, 2017; Hamdal et al., 2019, as cited in Cakir & Adiguzel,

2020; Northouse, 2018; Wu et al., 2020; Sarwar, Tariq, & Yong, 2022; Campos-García & Zúñiga-Vicente, 2019). Headteachers, as administrative leaders, significantly influence organizational efficiency within secondary schools (Nyakundi & Munyao, 2022; Joseph & Ideraola, 2021). Their leadership styles have been shown to affect overall performance, including financial outcomes (Flanigan et al., 2017; Al Khajeh, 2018; Bhargavi & Yaseen, 2016; Fujianti, 2018; Chan et al., 2019; Nwokocha & Iheriohanma, 2015; Northouse, 2018; Wu et al., 2020). Effective leaders motivate their subordinates, ensure effective communication, develop strategies for organizational growth, and create favorable work environments (Akpaprep et al., 2019; Cakir & Adiguzel, 2020; Hamdal et al., 2019). Such practices foster organizational efficiency (Haque, Faizan, & Cockrill, 2017).

Leaders adopt various leadership styles, each of which can either enhance or hinder organizational efficiency. For instance, while democratic leadership is often viewed positively, it can sometimes impede efficiency (Nwokocha & Iheriohanma, 2015). Conversely, characteristics of democratic leadership that involve staff in decision-making and delegation can enhance organizational performance (Sloof & von Siemens, 2021). Sarwar et al. (2022) found that college principals who applied democratic leadership styles improved teacher performance. Transformational leadership has also been associated with significant improvements in organizational performance and efficiency (Otila & Kyongo, 2017). Sarwar, Tariq, and Yong (2022) reported that headteachers who were growth-oriented and actively involved their staff in achieving organizational goals were more likely to succeed. This aligns with findings from Saleem et al. (2020) and Lee et al. (2019), who identified significant associations between transformational leadership and

performance. However, Yasmin et al. (2019) noted that both transformational and transactional leadership styles could negatively impact staff performance.

Gender has been identified as a factor influencing staff performance (Campos-García & Zúñiga-Vicente, 2019; Hendrawijaya, 2019; Met & Ali, 2014; Alshumrani et al., 2022). Campos-García and Zúñiga-Vicente (2019) found that female headteachers were associated with better school performance and higher technical efficiency ratios compared to their male counterparts. Conversely, male staff members have been reported to perform better in certain duties prior to becoming headteachers (Paskaleva et al., 2020; Budu et al., 2019). However, Alshumrani et al. (2022) found no statistically significant relationship between gender and various work outcomes, echoing earlier findings by Rao and Zaidi (2019).

Fujianti (2018) highlighted that the longevity of headteachers in the teaching profession significantly influences organizational technical efficiency. This finding is consistent with research by Mohammed (2015), Hendrawijaya (2019), and others. However, Anser et al. (2020) reported that this factor did not significantly affect staff performance, which is crucial for influencing school performance. The education level of headteachers has also been linked to their performance in several studies (Rao & Zaidi, 2019; Omori & Bassey, 2019; Nugroho et al., 2023; Harlina et al., 2019; Nadhar & Azis, 2019). Rao and Zaidi (2019) found a significant relationship between education and school performance, while Omori and Bassey (2019) asserted that more years of education enhance headteacher performance due to increased experience and contextual adaptation. This is supported by findings from Nugroho et al. (2023) and others. Interestingly, Thapa and Dhakal

(2024), Subedi et al. (2020), and others reported a negative relationship between education level and technical efficiency. The duration of leaders' tenure in organizations and their performance has been significantly linked to their personality traits (Joseph & Ideraola, 2021; Che Cob et al., 2024; Rababah, 2019; Toreros et al., 2019; Kang & Malvaso, 2023). Che Cob et al. (2024) found that performance was significantly associated with personality traits but not necessarily with the number of years spent in school. Traits like conscientiousness and extraversion have been linked to job satisfaction and performance (Rababah, 2019; Kang & Malvaso, 2023). Conscientiousness, characterized by reliability, organization, and responsibility, is associated with effective resource management and high technical efficiency (Kang & Malvaso, 2023). This may explain why conscientiousness is linked to high task and job performance (Judge & Zapata, 2015). Conversely, extraversion, associated with positive emotions and assertiveness, has been found to have a negative correlation with job satisfaction and organizational performance (Törnroos et al., 2019; Li et al., 2021). Increased work experience is generally associated with higher organizational performance (Omori & Basse, 2019; Hendrawijaya, 2019; Met & Ali, 2014; Harlina et al., 2019; Nadhar & Azis, 2019; Nugroho et al., 2023). Met and Ali (2014) reported that employees with over 30 years of experience were better performers, a finding echoed by Oyeniran and Akphorhonor (2019). However, Graham et al. (2020) revealed conflicting effects of teaching experience on performance, noting lower performance among teachers with 4 to 5 years of experience compared to those with 0 to 3 years. None of these studies explicitly examined technical efficiency as an outcome, suggesting that further assessment of these factors in relation to technical efficiency would yield valuable insights for secondary schools.

2.3 The institutional factors influencing the level of technical efficiency in universal secondary schools

An extensive review of the literature reveals that few studies have explicitly assessed the institutional factors influencing the technical efficiency of secondary schools, particularly those operating under Universal Secondary Education (U.S.E.) models. However, there are several studies from other sectors that identify institutional factors relevant to education systems, which are included in this section. Munoz and Queupil (2016) found that privately owned schools are generally more technically efficient than public schools. Similarly, Kyagulanyi and Tumwebaze (2019) reported that secondary schools not participating in Public-Private Partnership (PPP) arrangements exhibited greater efficiency compared to those that did. In health facility settings, studies by Obure et al. (2016), Ali and Debela (2017), Alhassan et al. (2015), and Zeng et al. (2014) consistently showed that private hospitals outperformed public ones in terms of efficiency. However, contrasting findings were reported by Jehu-Appiah et al. (2014) and Tynkkynen and Vrangbæk (2018), who found that public hospitals were more efficient than their private counterparts. Yahia and Essid (2019) concluded that the number of students positively affects a school's technical efficiency. Other non-educational studies have documented relationships between population density, infrastructural size, and technical efficiency (Nabyonga-Orem et al., 2023). However, Barasa et al. (2021) reported a negative relationship between population density and technical efficiency. The location of a secondary school is another influencing factor. Baba et al. (2021) found that schools in rural areas tend to be more technically efficient than those in urban settings. In contrast, Anselmi and Lagarde (2018) and Purohit (2016) reported that organizations located in less urbanized areas showed lower

technical efficiency. Several studies (Lamesgen et al., 2024; Chen et al., 2023; Barasa et al., 2021; Anselmi & Lagarde, 2018; Purohit, 2016; Obure et al., 2016; Top et al., 2019; Atake, 2019; Ali et al., 2017) have identified relationships between the number of staff in an institution and its technical efficiency. Lamesgen et al. (2024) noted that institutions with a larger staff were less likely to be technically efficient, a finding supported by Obure et al. (2016) and Top et al. (2019). Conversely, Atake (2019) and Ali et al. (2017) found that fewer staff members were associated with greater inefficiency. While these studies did not specifically focus on secondary schools, it can be inferred that the number of teachers in a school could influence its technical efficiency. In addition to staff size, the infrastructural size of an organization has also been linked to technical efficiency (Ayiko et al., 2020; Tesema, 2022; Jin et al., 2015; Baba et al., 2021; Ali et al., 2017; Yitbarek et al., 2019; Mujasi et al., 2016; Kalman et al., 2015; Giancotti et al., 2015). However, Baba et al. (2021) and Obure et al. (2016) reported that larger institutions tended to be less efficient, a finding echoed by Ali et al. (2017) and Giancotti et al. (2015), who noted that smaller facilities were less technically efficient. These findings align with theories of production that indicate increasing and decreasing returns to scale. Conversely, Yitbarek et al. (2019), Mujasi et al. (2016), and others found that larger hospitals were more likely to be technically efficient. In terms of financial resources, higher expenditure has been linked to increased technical efficiency in studies by Cao et al. (2022), Popescu et al. (2014), See and Yen (2018), and Gong et al. (2019). Similar results were reported by Moses et al. (2021), Cha et al. (2018), and Zeng et al. (2022). Ibrahim et al. (2019) also found that higher expenditure as a share of Gross Domestic Product (GDP) correlated with increased technical efficiency at the country level.

However, studies by Karpa et al. (2014), Allin et al. (2016), and Zeng et al. (2022) reported that high expenditure could reduce technical efficiency. These contradictory findings highlight the need for further investigation into the implications of Uganda's Universal Secondary Education policy and funding structures.

Monitoring and evaluation (M&E) practices, which involve the systematic collection and analysis of data to inform decision-making and foster accountability (Patton, 2018; Bamberger, Rugh, & Mabry, 2019), have also been associated with technical efficiency (Allin et al., 2017; WHO, 2015). Njiru and Thoronjo (2023) found that M&E positively impacted organizational performance, a finding supported by Uwera and Wanjiku (2023) and Masawe and Isanzu (2020). However, the emphasis on M&E in schools has been limited compared to other organizations, often subsumed under the responsibilities of headteachers. This study aims to examine M&E practices explicitly in the context of U.S.E. schools. Good governance has been linked to technical efficiency in several studies (Jordi et al., 2020; See & Yen, 2018; Ibrahim et al., 2019). Jordi et al. (2020) and Ibrahim et al. (2019) found that effective governance enhances technical efficiency, with Ibrahim et al. (2019) reporting that governance characteristics had the most significant influence on institutional technical efficiency. Conversely, Alhassan et al. (2016) found that effective governance could decrease technical efficiency. This discrepancy suggests that while technical efficiency aims for optimal resource use, effective governance must also be maintained.

Despite these insights, none of the studies examined technical efficiency as an explicit outcome variable. This highlights the necessity for further investigation into the applicability of these institutional factors in secondary schools, particularly in relation to technical efficiency.

2.4 Literature gap

Technical efficiency (TE) remains a significant area of interest in various studies, particularly within secondary education (Muvawala & Hisali, 2012). Ayiko et al. (2020) employed Data Envelopment Analysis (DEA) to benchmark homogeneous settings in general hospitals in Uganda to enhance efficiency. However, there is a lack of literature specifically addressing the assessment of TE, intrapersonal factors, and institutional factors in Uganda. A relevant study was found in Malaysia by Baba et al. (2021).

DEA and Stochastic Frontier Analysis (SFA) have been frequently utilized, often in conjunction with Tobit regressions (Akazili et al., 2008). Yet, no studies have adopted both DEA and Log-Binomial regression in educational research. The assessment of TE is rapidly gaining interest across numerous sectors, but reporting on TE within education remains limited. Additionally, TE results from non-homogeneous settings do not adequately explain the context of U.S.E. schools.

The inputs utilized in this study were not found in existing literature, and the combination of efficiency, systems theories, DEA, and the Log-Binomial model represents a novel approach. Intrapersonal and institutional factors also present a new context for research.

From the literature review in this section, three key observations emerged. First, the assessment of technical efficiency has consistently been a significant focus

across various sectors, especially in education, health, and agriculture. In the education sector, reported levels of technical efficiency range from 0.4 to 0.96; however, only a few studies have indicated the proportion of schools that are technically efficient.

Second, there is limited reporting on the specific levels of technical efficiency, and the types of inputs and outputs used vary across studies. Some studies have focused on a single input (e.g., teachers' salaries), while others have included different outputs beyond students' academic performance within the context of U.S.E. policy. Consequently, there have not been many studies assessing the technical efficiency of secondary schools using a comprehensive array of inputs, guided by systems theory and employing DEA alongside Log-Binomial regression.

Lastly, fewer studies have examined the factors associated with technical efficiency, particularly the intrapersonal factors related to school headteachers and institutional factors. This study seeks to measure technical efficiency based on all relevant input indicators within a school setting. Furthermore, not only will the mean technical efficiency be assessed, but the factors associated with it will also be analyzed

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the methodology that the study used to execute the research and obtain valid and reliable data was described. The chapter was organized into twelve sections, beginning with the philosophical underpinning of the study (3.1), followed by the study design and its justification (3.2), the study area (3.3), and the study population, including its eligibility criteria (3.4). It also covered the sample size calculation (3.5) and sampling procedures (3.6), the study variables (3.7), data collection techniques (3.8), quality control (3.9), trustworthiness (3.10), data management and analysis (3.11), ethical considerations and dissemination plan (3.12), and study limitations (3.13).

3.2 Philosophical underpinning of the study

There existed three major research philosophies: constructivism, positivism, and pragmatism (Guraya et al., 2023; Bergman, 2010; Johnson & Onwuegbuzie, 2004; Morgan, 2007; Levers, 2013; Bunniss & Kelly, 2010; Alharahsheh & Pius, 2020; Lin, 1998; Rehman & Alharthi, 2016; Andrew & Halcomb, 2007; Brierley, 2017). The positivist philosophy considered knowledge to be based on external sources dissociated from the researcher, particularly knowledge obtained from statistical analysis or numerical evidence (Guraya et al., 2023). In contrast, the interpretivist philosophy viewed knowledge in research as most reliably and validly obtainable from individuals who could socially construct it based on their experiences (Alharahsheh & Pius, 2020; Guraya et al., 2023). Pragmatism, on the other hand, represented an all-inclusive approach to research, where methodology,

epistemology, ontology, and axiology were based on evidence from statistical analysis as well as personal experiences (subjectivity) (Saunders et al., 2009; Andrew & Halcomb, 2007; Brierley, 2017). Furthermore, the pragmatism philosophy involved using multiple sources of data (quantitative and qualitative) to address the research questions or hypotheses at hand (Andrew & Halcomb, 2007; Brierley, 2017; Maxcy, 2003; Teddlie & Tashakkori, 2006; Creswell, 2015; Miller et al., 1996).

Agreeing with Allemang et al. (2022), pragmatism was deemed the most suitable philosophy for this study. It blended well with the postulates of systems theory, as both sought to solve social problems requiring a multipronged approach for resolution or understanding. One such problem was the technical efficiency of Universal Secondary Education schools in Uganda and the factors influencing it. Addressing this question necessitated that the study relied on both quantitative and qualitative data to obtain robust evidence.

3.3 Research design

The Mixed Methods methodology suited the pragmatism philosophy (Bogdan, 1975), in which both quantitative and qualitative data were collected to guide the study (Johnson & Onwuegbuzie, 2004; Maxwell et al., 2003; Bryman, 2006; Guest, 2013). In this study, the quantitative and qualitative data were collected sequentially (Abutabenjeh & Jaradat, 2018; Demir & Pismek, 2018; Guest, 2013; Johnson, 2014).

The explanatory sequential mixed methods design was adopted, where the quantitative data was collected first, followed by qualitative data (Gogo & Musonda, 2022; Schoonenboom & Johnson, 2017). The choice of this approach was

informed by the need to first objectively analyze the factors influencing technical efficiency and then use the obtained evidence to effectively moderate the qualitative interviews. This approach was expected to generate more dependable, credible, and reliable data through in-depth and key informant interviews, which would complement the key quantitative findings obtained from each objective (Schoonenboom & Johnson, 2017).

3.4 Area of study

The study was conducted in western Uganda (Figure 1), one of the regions of Uganda, a country located in East Africa. Uganda had embraced global development goals since 2000 and was striving to achieve the Sustainable Development Goals by 2030 (Parliament of Uganda, 2024). The country allocated resources, built capacity, and guaranteed parliamentary commitment to achieving these goals (Parliament of Uganda, 2024). One of the government's strategies to this end was increasing access to education for all Ugandans. Secondary-level education was one of the educational levels that the government emphasized in terms of accessibility for all eligible Ugandans.

Secondary education in Uganda ran for six years, with four years for ordinary level (Senior 1 to 4) and two years for advanced level education (Senior 5 and 6) (JICA & IDCJ, 2012). Ordinary level students sat for national exams in their third term of Senior 4, and those who were successful obtained the Uganda Certificate of Education (U.C.E.) (Nuffic, 2016). After Senior 4, successful students could choose to pursue advanced-level education for two years or join vocational training institutions, primary teacher training institutions (Grade III), or other departmental programs.

Education at the secondary level was provided in three types of schools that differed by ownership: private, government-owned, and community secondary schools (Uganda Bureau of Statistics, 2017; Kazuya & Chikako, 2016; Education Statistical Abstract, 2016). There was also a fourth category, international secondary schools, although these were few in number (Sentongo, 2018). This study focused on secondary schools in western Uganda that were beneficiaries of the U.S.E. policy. The western region comprised 891 secondary schools, of which 371 were Universal Secondary Education schools supported by the government. This indicated that U.S.E. schools made up 42% of all secondary schools in western Uganda.

Universal Secondary Education schools were the focus of this study because, unlike other types of secondary schools in Uganda, they received capitation grants that were ideally sufficient to enhance the quality of secondary education in those schools. However, despite the somewhat sufficient capitation (Ministry of Education and Sports, 2023), the schools had not exhibited significant improvements in performance on national exams. The National Planning Authority (NPA) had recently called upon the government to increase the grant for U.S.E. schools. Thus, it appeared that U.S.E. schools might not have been technically efficient in utilizing the current capitation grants, suggesting that an increase in funding may not necessarily lead to higher quality education.

As shown in Table 1, the region comprised four subregions, which included a total of 35 districts. The Ankole subregion had 87 (31.6%) of the schools, Kigezi had 76 (27.6%), Toro/Rwenzori had 68 (24.7%), while Bunyoro had 44 (16%) of the U.S.E. schools targeted in the study. The 275 U.S.E. schools were all government-owned

or grant-aided but founded by other stakeholders, and all U.S.E. schools were mixed-gender and day schools by policy.

Table 1: Distribution of U.S.E Secondary schools across the western region of Uganda (per sub region)

Sub region	Number of districts in sub region	Number of U.S.E Schools available
Ankole	12	87
Bunyoro	8	44
Kigezi	6	76
Toro/Rwenzori	9	68
Total	35	275

The actual study was school-based, that is, conducted at each of the sampled U.S.E schools, given that the targeted secondary school head teachers could be accessed at their respective schools where they have jurisdiction.

3.5 Population and Sampling techniques

3.5.1 Quantitative study population

The study population comprised headteachers or deputy headteachers (only one sufficed) of Universal Secondary Education schools in western Uganda. Both headteachers and their deputies were targeted because either could serve as fully fledged top school administrators, well positioned to provide valid data on school inputs and outputs as guided by the data collection tools required for assessing technical efficiency in each school. Additionally, the study sought data on intrapersonal and institutional characteristics, which both categories of school heads could provide validly.

3.5.2 Qualitative study population

The headteachers or their deputies participated not only in structured interviews but also in in-depth interviews, indicating that they were involved in both the quantitative and qualitative arms of the study. However, it should be noted that headteachers who participated in the quantitative interviews did not take part in the in-depth interviews.

Additionally, the study population included the respective district education system administrators, specifically the district education officers and school inspectors. These two categories of education system administrators served as key informants in the study and were engaged in key informant interviews.

Eligibility Criteria

The study included Universal Secondary Education school headteachers who had occupied their respective administrative positions for at least three years. This criterion was based on the assumption that a three-year period provided sufficient work-related experience, allowing each headteacher to offer the most validated data informed by their administrative experience. This was assessed after data collection during the sorting and editing process. Additionally, random data was collected from Universal Secondary Education schools that had been recipients of capitation grants from the government for a minimum of three years.

Headteachers or their deputies who had held their respective administrative positions in those schools during the three years (2017, 2018, 2019) considered in the assessment of technical efficiency were included. This requirement ensured that respondents' answers could be analyzed against the dependent variable

(technical efficiency), shaped by their administrative oversight, thereby increasing the reliability of the study and reducing data bias.

The study excluded headteachers and district education system administrators who were uncomfortable with having their responses captured digitally (voice recorded) during in-depth and key informant interviews, respectively. This exclusion was necessary because voice recording is considered a standard technique for data capture during qualitative interviews (Parameswaran et al., 2020; Tracy, 2019; Rutakumwa et al., 2019) and can guarantee accurate response collection. Without voice recording, the chances of omitting some responses would have been significantly high, compromising data reliability.

Secondary school headteachers who declared during the consenting process that they could not spare at least an hour for an interview were also excluded. This was due to the increased risk of item non-response and/or provision of inaccurate responses, potentially leading to data bias.

3.6 Sampling Techniques

3.6.1 Quantitative sample selection

The number of Universal Secondary Education school headteachers that was required in this study was determined using the formula by Daniel (1999). That formula is states as; $n = \frac{X \cdot N}{X + [N - 1]}$, and as can be noted in the formula, it bases its computation of sample size on the substitution of the population size (N). Thus, the formula by Daniel (1999) was most suitable for this study because there has never been an assessment of technical efficiency done in U.S.E schools within Uganda before, and so, there was no documented prevalence (p) or level of

technical efficiency available for use. This therefore justified use of the formula by Daniel (1999), and in addition, the formula has a feature that makes it suitable for use in situations when the population size is less than 10000.

The number of U.S.E schools and hence school headteachers that were targeted was 275, which is significantly less than 10,000, making it a small population size, that had to be corrected during computation. The formula by Daniel (1999) embodies a population correction factor in case the population size is less than 10,000. The parameters in the formula are defined as follows;

n = Sample size

X = Maximum sample size at 50% probability, given by the Kish Leslie formula (1965) as 384, as shown below;

$$n = 1.96^2 \times 0.5 (1-0.5) / 0.05^2$$

$$n = 3.841 \times 0.25 / 0.0025$$

$$n = 0.9604 / 0.0025 = 384$$

N is the population size = 275 U.S.E schools and hence 275 head teachers

Therefore;

$$n = 384 \times 275 / 384 + (275 - 1)$$

$$n = 105600 / 384 + (274)$$

$$n = 105600 / 658$$

n = 160 U.S.E school head teachers.

The study targeted 275 U.S.E schools, distributed across four sub regions, all of which had to be fully represented in the study. For maximum representation of

each of the sub regions, there was an option of stratifying the sub regions and then randomly sampling a section of U.S.E schools from each of them. Then, there was an option of simply randomly sampling the U.S.E schools, so that the sampled ones represent the sub regions, without bias. However, while both sampling approaches were practical, none of them could be methodologically viable, given that the target population size (275) was quite small, with respect to the fact that a sample size of 160 was required. In essence, random sampling (simple or systematic) would not have been suitable for sampling the schools since it bases on probability and hence the elimination (non-sampling) of at least half of the elements in a given sampling frame. If random sampling had been used therefore, chances were high that the sample size of 160 secondary school head teachers would have been obtained, especially given that not all the 275 targeted were guaranteed to consent.

Therefore, the principal investigator chose to make a census of all the four sub-regions in western Uganda, first, given the need to have all of them represented (Australian Bureau of Statistics, n.d). Following the census of the sub regions, a list of all the 275 U.S.E schools was developed, and this constituted the sampling frame of the schools. As justified above, a non-probabilistic sampling method was used, and the most suitable one was consecutive sampling. Consecutive sampling refers to the recruitment of a given study subject, on the sole premise of it being eligible for inclusion into the study (Polit and Beck, 2017; Setia, 2016). Consecutive sampling is considered to be the best and most merited among all nonprobability sampling approaches (Polit and Beck, 2017; Setia, 2016), given that it allows for the inclusion of all eligible study subjects, hence minimizing selection bias.

To conduct consecutive sampling, the schools earlier listed had each of their head teachers reached out to via telephone, with the telephone contacts obtained from the Association of secondary School Headteachers of Uganda leadership structures, East African phone directory and the respective district education officers, whenever possible. This reach-out via telephone was done to not only establish rapport, but also determine eligibility of the head teacher for inclusion and the school as well. Once eligibility was established (as stipulated in section 3.4), that school was taken as sampled and written on a separate list of sampled schools. The process was done, serially, on the sampling frame, until 160 schools had been sampled. At each of the schools, the head teacher was purposively sampled, if they met the eligibility criteria of the study.

However, the consecutive sampling came along with one limitation, and that was the risk of over sampling from one of sub regions, and/or under sampling in another. To solve this, the technique of proportionate sampling according to the population size of U.S.E schools per sub regio was used (Table 1). The proportionating was done using the formula;

$N_a = N_b / N_c \times n$, which is true when

N_a = Number of U.S.E schools and hence secondary school head teachers required from each school

N_b = Number of U.S.E schools and hence secondary school head teachers available in a given sub region

N_c = Total number of U.S.E schools and hence secondary school head teachers required from each school available in all the four sub regions (275)

n = Sample size (160)

Table 2:Proportionating of sample size according to the population size of U.S.E schools per sub region

Sub region	Number of districts in sub region	Number of head teachers in sub region	Total number of head teachers in the region	Sample size	Number required from each sub region
		Nb	Nc	N	Na
Ankole	12	87	275	160	51
Bunyoro	8	44	275	160	26
Kigezi	6	76	275	160	44
Toro/Rwenzori	9	68	275	160	40

3.6.2 Qualitative sample selection

The qualitative domain of this study did not have a predetermined sampled size of secondary school head teachers (in-depth interviews) and education sector administrators (key informants) that were needed to participate in those interviews. That was because, unlike in quantitative studies in which the number of participants matters a lot, in qualitative studies, it is not about how many participants are interviewed, but rather, the quality of the responses obtained from them (Saunders et al., 2018). Therefore, an emergent sample size was based on, that is, one that emerged during the data collection exercise. Thus, the number of head teachers and district-level education system administrators that the study needed was determined using the data saturation principle. According to Morse (2015: p.587), data saturation is a constant in all qualitative studies. Data saturation is considered to be a ‘gold standard’ for determining sample sizes in qualitative studies (Guest, 2006), and even when some authors have disagreed with that stand point in the past (Walker 2012; O’Reilly and Parker 2013; van

Manen et al. 2016; Nelson, 2016; Dey's, 1999), there is general consensus that data saturation has to be looked out for when conducting qualitative data collection.

By definition, data saturation refers to a point during data collection, at which overlap of responses is noted (Morse, 2015; Guest, 2006; Otmar et al. 2011; Jassim and Whitford 2014; Kazley et al. 2015). Corbin (1998 p. 136) considers it to be a point that every qualitative data analysis should not miss out on. Mason (2010) in fact, emphasizes that during qualitative data collection, there is a point when further data collection is counterproductive, with no more need for more interviews. With that principle, in-depth interviewees and key informants were interviewed consecutively until overlap of information is noted, at which point data collection was stopped (Saunders et al., 2018).

In this study, data saturation was noted at the 17th in-depth interview with the head teachers, and at the 14th key informant interview. According to Morse (1994, p.225), Creswell (1998, p.64), Creswell (1998, p.64), Bertaux (1981, p.35) and Guest et al. (2006), data saturation can occur anywhere between 15 and 50 interviews, implying that the sample sizes considered in this study were sufficient enough.

For the qualitative study, head teachers of U.S.E schools that were not sampled in the quantitative consecutive sampling process were the ones considered as potential participants in in-depth interviews. They were thus purposively sampled, firstly, on the aforementioned premise, and then, on the premise of meeting the inclusion criteria of the study as well. Purposive sampling, which refers to the selection of participants that are expected to be in position to provide all information required, on a subject matter at hand (Kelly, 2010: 317; Mason,

2002; Robinson, 2014; Trost, 1986; Palinkas et al., 2015; Shaw, 1999; Andrade, 2020). The same sampling method was used to sample key informants, that is, district education officers (D.E.Os) and district education inspectors, for as long as they met the inclusion criteria (Section 3.4).

3.7 Variables Definition and Measurement Levels

This study included two independent variables (intrapersonal and institutional characteristics) and one dependent variable, technical efficiency. Indicators within the three exposure variables were of nominal, ordinal, and scale character and were measured accordingly during analysis. All exposure variable data was collected from structured interviews and document reviews when necessary. However, dependent variable data was collected using document reviews conducted by key respondents only, as this information was readily documented in the administrative records of each respective school. The dependent variable was measured as a scale variable during analysis; however, in practical measurement, technical efficiency was assessed using the Data Envelopment Analysis (DEA) approach.

Technical efficiency can be measured using a non-parametric approach like DEA or a parametric one, such as Stochastic Frontier Analysis (SFA) (Mbau et al., 2023). However, DEA was the most widely used measurement technique for assessing technical efficiency in organizational management, as confirmed by a recent systematic review (Mbau et al., 2023) and evidenced in previous studies (de Cos PH, Moral-Benito et al., 2014; Kujawska, 2018; Stefko et al., 2018; Pelone et al., 2015). DEA, based on linear programming, was employed to measure the performance of institutions or institutional units. Introduced by Charnes, Cooper,

and Rhodes (1978), DEA had been extensively used over the previous four decades to measure efficiency in numerous organizations, including banks, schools, and construction companies (Sherman & Gold, 1985; Shang & Sueyoshi, 1995).

DEA had several merits that made it the preferred tool and methodology for measuring institutional technical efficiency. One advantage was its ability to utilize multiple inputs and outputs to determine efficiency, making it an all-inclusive measurement tool suitable for institutions like schools, which have various inputs and outputs (Bhagavath, 2006). However, DEA also had a downside; being deterministic rather than statistical in its measurement, its results were sensitive to measurement error and conducted efficiency measurements through comparative analysis between a given institution and the most efficient one (Bhagavath, 2006). The merits of DEA outweighed its demerits, and as such, it was used, with technical efficiency deemed as such for any school that scored 100% in the DEA assessment.

Table 3:Description of study variables

Variable	Indicators	Data collection method	Measurement during analysis	Data analysis subjected
DEPENDENT Technical efficiency	<p style="text-align: center;">INPUT</p> <ul style="list-style-type: none"> •School student enrolment •Number of classrooms •Mean amount of money spent to run the school per year •Number of teachers (Staffing) •Student teacher ratio •Teacher quality •Quality of students `admitted into Senior one •PTA contribution to teachers <p style="text-align: center;">OUTPUT</p> <ul style="list-style-type: none"> •Performance Index in Uganda Certificate of Education Examinations results for three years 	Document review	Scale	Descriptive (DEA, mean, median, SD, frequency distributions)
INDEPENDENT Intrapersonal characteristics	<ul style="list-style-type: none"> •Gender of headteacher •Age •Current level of qualification •Category of teaching subject specialised in. •Duration in teaching profession •Duration as headteacher in the school •Applies conceptual skills •Assesses the school's Strength, Weaknesses, Opportunities, and Threats annually. •Sets Goals, Objectives or Targets for the school Annually •Schedules activities in the school for the whole term/Year •Reviews the school management structure after every three years •Networks with other schools for support of each other •Aligns School plans with Vision, Mission, and Core values of the school •Delegates staff with different management tasks in the school •Holds informal conversations with teaching staff •Holds informal conversations with non- teaching staff •Handles disputes among staff as soon as possible •Invites Board of Governors (BOG) sometimes for interactive discussions about the school matters with school staff. •Invites PTA executive members sometimes for interactive 	Structured interviews	Scale, Ordinal and Nominal	Multivariable analysis

- discussions about school matters with the staff
- Participates in Social and Community events.
 - Weekly supervises subordinates (support Supervision)
 - Sees ongoing work activities and conditions of the facilities and takes requisite actions.
 - Operates using the school action plan that guides completion of school programmes
 - Customises the national curriculum to fit the school's departmental levels.
 - Sets guidelines to monitor students' termly performance
 - Carrys out staff skills needs assessment.
 - Carrys out professional development workshops.
 - Conducts individual teachers' evaluation of performance termly

Institutional characteristics

- Mean enrolment of students
- School land size
- Mean annual budget of school
- Mean PTA to teachers
- Mean teacher enrolment
- PLE quality intake
- Adequacy of resources in the school.
- Level of parental involvement in the affairs of the school
- Location of the school
- Main energy source of the school
- Main water source of the school

Structured interviews

Nominal and Ordinal

Multivariable analysis

Region of location

Ankole
Rwenzori
Bunyoro
Kigezi

Founding body

Anglican
Catholic
Government
UMSC

Mean enrolment

Less than 500
501 - 1000
1001 - 1500
1501 - 2000

School land size

< 10 Acres
10 - 20 Acres
21 - 30 Acres
More than 30 acres

Annual budget

< 50 million
51 - 200million
201 - 350 million
351 - 500 million

PTA To teachers
10000 - 40,000 Ugx
40,100 - 70,000 Ugx
70100 - 100,000 Ugx
Teacher enrolment
< 10 Teachers
10 - 20 teachers
21 - 30 Teachers
More than 30 teachers
PLE quality intake
High (0.7 - 1)
Moderate (0.5 - 0.69)
Low (<0.5)
Adequacy of resources
Adequate
Inadequate
Parent involvement
Adequate
Low
Very low
Location status
Urban
Semi-urban
Rural
Energy source
Electricity / generator
Solar
Water source
Tap water
Borehole / well

3.8 Procedure for Data collection

3.8.1 Quantitative data collection methods

The study used four data collection methods: structured surveys, document analysis, in-depth interviews, and key informant interviews. The first data collection method applied was structured surveys, characterized by posing a set of questions with predetermined response choices to respondents, who then selected what they deemed most appropriate (George & Merkus, 2023). Structured surveys were chosen as the quantitative data collection method because, by design, they solicited quantifiable responses that could be used in quantitative analysis (descriptive, bivariable, and multivariable analysis). Furthermore, structured surveys (interviews) involved asking similar questions to all respondents without any discrepancy, which enhanced their reliability (Bernstein, 2002; Janis & Hatef, 2008; Bajaj & Carmichael, 2004; Nallasamy, 2010; LaGrasso, 2008; Hermelin & Robertson, 2001).

Following the structured interviews, the second data collection method applied was document analysis, which referred to the critical review of any document of interest for generating contextual data and determining how pre-documented data fit a certain prescribed purpose (Bowen, 2009). The document analysis was conducted using the READ approach, where materials for the analysis were made Ready, followed by the Extraction of data from school records, which was then Analysed, and the findings Distilled (Dalglish et al., 2020). Document analysis was used to obtain data from school records, particularly regarding the measurement of technical efficiency for each sampled secondary school. It should be noted that technical efficiency data included information on school enrollment, staffing, funds used, and academic performance for a three-year period. Such data could not be validly self-reported by the headteachers; it had to be verified documentarily

3.8.2 Qualitative data collection methods

Once quantitative data had been analyzed, qualitative data was also collected, with the findings from the quantitative survey used in the qualitative interviews. In-depth interviews which are open ended interviews meant to solicit personal views and opinions, from people, who by virtue of their position in society or community possess information that is of specific need to a study were conducted first. One category of such people were headteachers, particularly in a study of technical efficiency and what influences it, since they head schools that are meant to be efficient. Those headteachers could not be mobilized into focus groups, given their busy schedules, and the fact that they are dispersed across four sub regions. That was in addition to the fact that focus groups are constituted by 4 to

12 people, and with them, saturation can happen after conduction of five of more focus groups. As such the population size that remained after the quantitative study (115) could not have been sufficient to allow for use of focus groups, making in-depth interviews the most suitable.

Key informant, were persons considered to have information by virtue of the positions they occupy in a given community, or institution (Akhter, 2022). The need for key informant interviews in this study was informed by the fact that whereas respondents (headteachers) were engaged to provide their opinions and views, it was very possible that their leaders and/or administrators in the respective district-level education sectors were in an even better good position to provide valuable information about the level and factors influencing the technical efficiency of U.S.E schools in western Uganda. Both in-depth and key informant interviews were moderated by the principal investigator himself, and lasted between 1 and 1.5 hours, in order to prevent respondent fatigue, and they were all voice recorded. Voice recording was an inevitable data collection addition given that note taking can be sufficient for capturing responses put forward by each of the participants (Dullas et al., 2021; Schulkind et al., 2016). Voice recording has been found to effectively facilitate later data transcription more than note taking alone (Krueger & Casey, 2015; Gill, 2008; Kitzinger, 1995).

3.9 Data Collection Instruments

The study used three data collection tools which included a structured questionnaire, interview guides. These tools were sufficient because the data from the document review was still captured on the structured questionnaire (Appendix

B), which is designed with close-ended questions, with multiple choice responses from which a respondent chooses. The questionnaire was designed with five sections, A,B,C,D and E, in which socio- demographic, technical efficiency, intrapersonal and institutional characteristics were assessed respectively. The questions in all the five sections were of categorical and ordinal type, with some being scale-type questions.

The second and third data collection tools were in-depth (Appendix C) and key informant interview guides (Appendix D), both of which were designed with open-ended questions. However, it should be known that unlike in structured or semi-structured interviews, the interview guides that were used in this study were not used to explicitly capture the responses put across but rather, to largely, guide the moderation of the interview. Responses from the interviews guides were captured using a digital voice recorder and in addition, note taking was also done. The choice of audio recording as the main form of data capture is premised on the need to have none of the crucial insights and opinions of the key informants of respondents (school head teachers and district-education system administrators) missed, as could be the case in note taking alone. Both interview guides were designed with open ended questions so as not to limit the respondents in providing their opinions. All questions included in the interview guides were strictly aligned towards the threestudy objectives, so as to allow for complementation of the quantitative data, with qualitative data (Gogo and Musonda, 2022; Schoonenboom and Johnson, 2017).

3.10 Quality control

3.10.1 Quality control (Quantitative study)

Quality control for this study involved four activities, one of which was the training of research assistants. Assistants were of importance in this study because the study was conducted literally across the entirety of western Uganda. Therefore, the principal investigator needed to have a team that could be dispatched to various areas (sampled U.S.E schools) to assist with quantitative data collection, while he covered other areas. The assistants were persons of both sexes, graduates, and with considerable experience in survey research data collection. Nonetheless, the principal investigator still provided them with extra orientation training in as regards the study at hand. The training centered on what the purpose of the study was, how the head teachers were to be sampled with respect to the study inclusion criteria, how technical efficiency was to be assessed, the data collection methods that were to be used, and all ethical considerations that the study had.

The trainees were also taken through each of the items in the data collection tool; however, the training was conducted using a tool that had been already validated for content. Therefore, content validity index testing was also done, by purposively choosing four experts in the area of education research, and data management and analysis. They were each given the developed tool (Appendix B), and a scale for rating the items in that tool. The scale was comprised of three ratings; very relevant (4), relevant (3), somewhat relevant (2) and not relevant (1), and once each expert did their rating, the mean number of items considered to be very relevant and relevant was computed.

Their ratings were as follows;

Table 4: Content validity rating

Expert number	Items rated 4	Items rated 3	Items rated 2	Items rated 1
1	70	4	0	0
2	65	11	0	0
3	57	16	0	0
5	61	10	0	0

Therefore, the items that were rated as 4 and 3 by each expert were; 74, 76, 73 and 71 and so, the number of items rated 4 or 3 was $74 + 76 + 73 + 71 / 4 = 74$ items.

To compute the content validity index, this formula was used; items rated 4 or 3 / number of items in the tool x 100, was used and this resulted into a fraction, $74 / 80$, which yielded 0.92, which was in the range of 0.7 and 0.99. This implied that the tool had all the items needed to collect data required to answer the research questions (Bland and Altman, 1997; Nunnally and Bernstein, 1994; DeVellis, 2003; Cronbach, 1951).

Assistants were also invited to participate in a pretest study during which the study tool was administered to a sample of 10 secondary school head teachers in U.S.E schools within Mubende district. Mubende district was chosen as a study area because like most districts in western Uganda, it has U.S.E schools that receive capitation grants and have been doing so for more than five years, although their output does not seem to commensurate the increase in capitation provided by the government in 2022 and 2023. Thus, some schools in Mubende certainly had

technical efficiency gaps, which made some of those U.S.E schools to be appropriate pretest areas. The 10 pretest U.S.E schools were sampled in a similar manner as those in the main study were to be sampled, in order to mirror the main study as much as possible and obtain findings that could directly inform the main study.

During the pretest, it was determined that two questions that had been duplicated in the intrapersonal characteristics section, and one of them was later removed. Two of the questions in the institutional characteristic sections were paraphrased to reduce their sensitivity and directness in approach, plus, to make them more comprehensible to the respondents. The pretest also revealed how best the head teachers could be engaged, to obtain data from them and also access school records, some of which are not meant for the public to consume.

The data obtained from the pretest was used in analysis of the reliability of the questionnaire, using the Cronbach's alpha. That alpha is considered to be one of the most important statistical tools in research that involves reliability testing (Cortina, 1993, p. 98; Schmitt, 1996, p. 350). It was primarily developed to measure the internal consistency of study tools, that the extent to which the items in a given tool are interrelated, or measure the same concept (Tavakol and Dennick, 2011). An internally consistent questionnaire is one that has small error variance and is expected to collect more reliable data (Tavakol and Dennick, 2011; Nunnally J, Bernstein, 1994). Therefore, to ensure that the questionnaire to be used could collect data with as little measurement error as possible, reliability testing using the Cronbach's alpha test, in SPSS version 25. From the assessment (Table 3 and 4), it is shown that the alpha was 0.772, which according to Bland and

Altman (1997), Nunnally and Bernstein (1994), DeVellis (2003) and Cronbach (1951), implied that the tool was reliable enough to collect data with insignificant measurement error.

Table 5: Scale statistics

Mean	Variance	Std. Deviation	N of Items
4.6146	0.321	0.56685	80

Table 6: Reliability Statistics

Cronbach's Alpha	N of Items
0.772	80

3.10.2 Trustworthiness (Qualitative study)

To ensure trustworthiness, which is an equivalent of quality control in a quantitative study (Cornish et al., 2020; Nwaka et al., 2020; Torrance, 2018), a number of techniques were adopted by the principal investigator (Nyirenda et al., 2020). They included credibility, dependability, transferability, triangulation, conformability reflexivity, Data management rigor, and persistent observation as informed by (Cornish et al., 2020).

Credibility

According to Merriam (1998) credibility refers to the confidence that can be accorded to the findings obtained by a given study, particularly in terms of being the actual representation of the opinions of the respondents. Credibility of the study was ensured by (1) engaging the respondents (head teachers, D.E.Os and

inspectors) in in-depth and key informant interviews for as long as possible so that as much deliberation can be done by them including confirmation of any of their previous provided responses, but taking care not to cause respondent fatigue, (2) becoming familiar with the study setting and its dynamics, prior to data collection, so that rapport can be established with all available school leaders, with the result being that once data collection starts, the sampled persons do not conceal relevant responses (3) carrying out persistent observation during focus group discussions so that any characteristics and elements that were most relevant to the problem or issued under study, could be allocated much more deliberation time on the part of the respondents (Korstjens & Moser, 2018).

Triangulation

Secondly, data triangulation, which refers to the collection of data from multiple sources (Korstjens & Moser, 2018, pp. 120-124) was also used in order to uphold data trustworthiness. To achieve triangulation, more than one data sources was used, that is in-depth interviews and key informants (head teachers, D.E.Os and inspectors, respectively). Secondly, data was collected using multiple data sources in time (gathering data in different times of the day), and space (on the same phenomenon but in multiples sites).

Transferability

Korstjens & Moser (2018) define transferability as the degree to which the findings obtained in a given context can be juxtaposed to another context having a difference caliber of respondents. It is the equivalent of external validity in quantitative studies. In order to ensure that the study and its findings were transferable, a thick description of the study procedures was done, so that other

persons could ably determine whether the study can be transferable to their own settings (transferability judgment). A rich account of descriptive data, such as the context in which the research was carried out, its setting (western region, its sub regions and U.S.E schools therein), sample (head teachers, D.E.Os and inspectors), sample size, sampling strategy, study population, and inclusion and exclusion criteria, interview procedure and topics, changes in interview questions based on the iterative research process, and excerpts from the interview guide were provided as well

Dependability

Cornish et al. (2020), Bryman (2004), and Trochim (2006) define dependability as the stability of study findings over time, implying that the findings of the study can only be dependable if within a number of years, the same findings or largely similar ones can be obtained from a given setting. The fact that dependability includes the aspect of consistency, it was ensured by first and foremost carrying out training of the two research assistants that were recruited to assist with the note taking, during the qualitative interviews.

Their training was focused on mainly what the study was about, its objectives, and how to take notes that will later be used as sources of possible emergent themes. Secondly, it was ensured that the analysis process that was carried out was in line with the accepted standards for qualitative analysis. Thirdly, member checking was also applied, with peer level members and even with the supervisors, to verify the quality of the data and in order for the principal investigator to have feedback before submission of the final set of findings could be done (Swimberghe et al., 2014).

Conformability and reflexivity

Conformability is defined as the extent to which the findings obtained can be confirmed as being true, by the respondents themselves and peers as well (Cornish et al., 2020). It is an indicator of the fact that the findings were not derived from the principal investigator's imagination, but rather from the respondents themselves. At the end of each interview a recap of the responses that had been provided by each session was made by the moderator, to the respondents, following which they were asked to confirm whether the recap made constituted what they had provided as their responses.

Reflexivity

Reflexivity refers to the process of preventing the principal investigators own biases, opinions, pre-conceived notions and preference from taking precedence at the expense of the respondents own (Cornish et al., 2020). Reflexivity involves critical reflection on the part of the researcher, and is considered to be at the heart of knowledge construction during the data collection process (Bradbury-Jones, 2007; Narayanasamy, 2015; Flick, 2013; Pillow, 2003; Visweswaran, 1994; Davies, 2008; Probst and Berenson, 2014; Bourdieu, 2004). Therefore, principal investigator also employed bracketing when interviewing the respondents and reporting the findings, so that the emergent findings were not based on the principal investigators own preferences and feelings, but the respondents only.

Data management rigor

Rigor, in qualitative research terms refers to the extent to which conclusions made following the thematic analysis process are well founded and sound (Nyirenda et

al., 2020).Nyirenda et al. (2020) emphasized that rigor has to be considered in every qualitative study. A number of strategies were therefore adopted in order to ensure rigor(Walker, 2022, pp. 22-24) and they included credibility reflexivity, and transferability. Unlike the reflexivity context of trustworthiness, reflexivity in the thematic data analysis process refers to having a reflective attitude throughout the study (Mohajan, 2018). Therefore, the principal investigator had the same when reading through each of the transcripts, questioning each of them and deriving meanings in the process (Akhter, 2022).

Credibility refers to the meaningfulness of the findings generated and the extent to which they are well presented (Kitto, Chester, & Grbich, 2008). The principal investigator ensured that the entire process of thematic analysis that was used has been comprehensively and justifiably described (Sandler et al., 2016). That is in addition to describing how the findings have been presented, and what was based on to determine which findings was precedent.Transferability, which in thematic analysis rigor terms refers to the soundness, realisticness, usefulness and novelty of the findings (Sandler et al., 2016) was ensured by first describing the findings clearly, in an understandable manner that could allow for transferability to other broader contexts.

3.11 Data Processing and Analysis

3.11.1 Quantitative data analysis

All questionnaires were checked for completeness before entry and when entered, care was taken to check each of the columns in the data view of each of the statistical packages that were used, for any anomalies in code entry. It should be

noted that two statistical software packages were used, and those were STATA 17 and SPSS version 25, premised on the fact that the DEA could not be analyzed in SPSS, but rather in STATA. Therefore, DEA was done in STATA 17, wherein, the technical efficiencies of each decision-making unit (DMU), i.e. a given school was computed, along with the mean, minimum and maximum efficiencies. The technical efficiencies of each school (DMU) were then entered in SPSS 25, along with all the data from the independent variables. When all data entered was ascertained as being clean, the analysis was done, commencing with the descriptive analysis of each of the variables. For the first objective, however, descriptive analysis was the only one done since the outcome of that objective was the level of technical efficiency of each school, which is a percentage. Following the descriptive analysis of all variables, those in objective 2 and 3 were subjected to descriptive cross tabulation analysis, where each was cross tabulated with the dependent variable (technical efficiency). The cross tabulations indicated the distributions of each of the frequencies in the independent variables, within the dependent variable.

Whereas those cross tabulations indicated the intrapersonal and institutional characteristics of the majority of the U.S.E school that had optimal technical efficiency, there was need to establish the significance of each relationship cross tabulated. However, this was done for only variables that had no zero (0) counts in their cross tabulations, since it is only for them, that ratios and confidence intervals could be computed.

3.11.2 Log-Binomial regression model.

The multi-variate analysis of the intrapersonal and Institutional factors was done using a Log-binomial model with the following functional

form: $\text{Log}\left(\frac{P(Y = 1/x)}{P(Y = 0/x)}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n + \varepsilon$, where $\left(\frac{P(Y = 1/x)}{P(Y = 0/x)}\right)$, is the

Probability of being technically efficient and $\left(\frac{P(Y = 0/x)}{P(Y = 1/x)}\right)$, is the Probability of Not being Technically efficient. While $\beta_1, \beta_2, \dots, \beta_n$ are coefficients of the predictor variables that were found significant at bivariate analysis level; x_1, x_2, \dots, x_n and β_0 is the intercept. Each β_i represents the change in the Log odds of being technically efficient for a unit change in x_i . Y was the binary outcome variable (Technical efficiency) where, Y=1 represents a school that is technically efficient with values of 0.822 to 1 and Y=0 represents a school that is not technically efficient with values less than 0.822.

The log-binomial model was used because the magnitude of the outcome (technical efficiency) was found to be less than 10%, which implies that the assumptions of its use were fully met (McNutt et al., 2003; Barros and Hirakata, 2003; Behrens, 2004; Greenland, 2004). At that magnitude of the outcome, the log-binomial model is highly accurate in estimating p values, unlike a binary logistic regression model, which overestimates the p-value, at the same magnitude (McNutt et al., 2003; Barros and Hirakata, 2003; Behrens, 2004; Greenland, 2004). The bivariate analysis was done between the intrapersonal, institutional characteristics and technical efficiency, and it yielded crude prevalence ratios, at a confidence interval of 95%. The alpha was set at 5%, however, all variables with p

values less than 0.05 were further fitted into a multivariable log-binomial model, and adjusted for confounders. Crude Prevalence Ratio(cPR) is the measure of the association between an exposure and an outcome variable without adjusting for any confounding variables. It compares the prevalence of the outcome in the exposed group to that in unexposed group. Then cPR is >1 , it indicates a higher prevalence of the outcome in the exposed group compared to the unexposed group. When cPR is <1 , it indicates a lower prevalence in the exposed group.

Following bivariate analysis, all variables whose p-values were less than 0.2 were fitted into a multivariable log-binomial model in which adjustment for confounders was made. This yielded adjusted prevalence ratios (aPR), which is a measure of the association that has been adjusted for potential confounders. It provides a more accurate estimate of the relationship between the exposure and outcome variables by controlling for other variables that might influence the association. Statistical significance at this stage was set at an alpha level of 5%, meaning that all variables with p-values less than 0.05, after adjustment remained significant and were considered to be the factors influence technical efficiency among U.S.E schools in western Uganda.

3.11.3. Quantitative Data Analysis Testing of Assumptions

a) For DEA diagnostics, the sample size check followed the rule of $DMU \geq \text{Max}(\text{inputs} * \text{outputs})$ or $3(\text{inputs} + \text{outputs})$. This criterion was met, as there were 160 DMUs, the product was 7, and the sum equaled 21.

b) Pearson correlation was employed to test for collinearity among inputs and outputs. No collinearity was detected, as the maximum Pearson r was 0.53.

c) Jackknife DEA and tests of goodness were utilized to identify outliers and assess sensitivity. These tests revealed goodness of fit and convergence.

d) A Log-Binomial regression check for multicollinearity convergence at $VIF < 10$ was conducted, and it converged at $VIF < 5$.

e) Therefore, both DEA and Log-Binomial regression models satisfied the core assumptions. Affirming the robustness of the TE estimates and the identified determinants.

3.11.4 Qualitative data analysis

Qualitative data generated from in-depth and key informant interviews, was analyzed thematically, which in hermeneutic terms refers to the interpretation of data, and enlightenment on the actual meanings embedded within a given set of qualitative responses (Ho et al., 2017; van Manen, 2016; Sundler et al., 2019). Generally, the thematic approach of qualitative data analysis is meant to appreciate the complexity of meanings within the data, but not the frequency of how each response occurs (Sundler et al., 2019). Whereas a number of thematic analysis approaches exist, the analysis of data in this study was conducted using the thematic analysis approach by Braun and Clarke (2006).

Generally, the thematic approach of qualitative data analysis is meant to appreciate the complexity of meanings within the data, but not the frequency of how each response occurs (Sundler et al., 2019). Whereas a number of thematic analysis approaches exist, the analysis of data in this study was conducted using the thematic analysis approach by Braun and Clarke (2006). The approach involves implementation of six steps. The first step implemented in this study was familiarization with data, which involved open minded reading through the

transcribed text. The second step was the generation of codes within the data, for each group of responses showing commonality in meanings.

In the third step, the codes identified were then combined into emergent themes, following a search for them and the description of patterns in the meanings in each. In the fourth step, the themes developed were reviewed, organized into meaning wholeness under their respective predetermined themes (the three objectives) and their significance will be determined in the fifth step. In the sixth step, the emergent themes were then provided narratives to, in order to make meaning out of them and understand what the opinions of the respondents were (Sundler et al., 2019). Importance of a particular emergent theme was established based on the level of recurrency of the responses provided on it, with the most recurrent one being considered most important, under a particular sub theme.

3.12 Ethical considerations

Approval to conduct this study was obtained from the Uganda Christian University Research Ethics Committee (UCU-REC) (Appendix G), and from the Uganda National Council of Science and Technology (UNCST) (Appendix H). Approval letters from the University REC and UNCST were used to seek permission to have the study conducted in the western region, from the Ministry of education and Sports (Appendix I). The aforementioned permission documents were then used to obtain final permission from the respective district education officers in each sub region.

Before data was collected from any of the respondents, each was given an informed consent form (information sheet) (Appendix A, Appendix C, and Appendix E), which they were requested to read through in order to appreciate the purpose of the study, the risks and benefits of participating in it, the roles of the respondents and

their rights, among other things. This consenting process was meant to empower the potential respondents with discretion to choose to be part of the study or not. Those who chose to be participants in the study were requested to append their signatures (written consent), as a show of consent, upon which they were engaged in interviews.

All data collected was handled with utmost confidentiality; every single questionnaire was mobilized from the data collection assistants at the end of each data collection day, and kept with the principal investigator in a personal lockable cabinet. Even when it came to data entry and analysis, the two were done on the principal investigators personal, password protected computer. Raw data was guarded very much from any hackers to ensure that their high level of confidentiality. Proper encoding was observed to avoid any identity of a headteacher of a school as the source of specific data. This data had to be kept confidential because of the sensitivity of some of it, particularly that related to technical efficient inputs.

Consequently, all data (including voice recordings) was anonymized, to conceal the identities of not only the schools sampled, but also their headteachers. Even during transcription and thematising of qualitative data, pseudonyms were used to annotate each response. No participant was forced to participate in the study, voluntary participation was observed. The participants had the right to withdraw from participating in the exercise of proving the required data at any time without any penalty.

3.13 Study imitations

This study had a few limitations that could have affected the reliability of findings to an extent; all data on inputs and outputs was abstracted from school records, with the implication that in case of any errors that could have been made during primary entry, by whoever captured institutional data, such errors were possibly carried forward into this study, as we couldn't manipulate any of the records that the schools had prior captured as their inputs or outputs. However, as a counter, the principal investigator endeavoured to verify each of the captured data entries on inputs and outputs, with the given schools headteachers, before final abstraction or document reviews could be done. This ensured that any anomalies in institutional data entry could at least be modified by the institutional heads themselves, before capture by the data collection team.

All data on intrapersonal and institutional characteristics was self-reported by the respective institutional heads, with the implication that there could have been some exaggeration on the part of the respondents, which may have affected the quality of the findings. However, while that could have been a possibility, the principal investigator and his data collection assistants endeavoured to probe most of the questions that could be easily exaggerated. That ensure that by the time a response was captured, a given interviewee had been accorded time to perhaps reconsider it, prior to providing a confirmatory response to be captured.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter presents the findings of the study, organized in four sections, in which sociodemographic characteristics (4.2), findings from the assessment of technical efficiency (4.3), findings from the assessment of the intrapersonal factors associated with technical efficiency (4.4) and findings from the assessment of institutional factors on technical efficiency (4.5) are presented.

4.2 Sociodemographic characteristics of the respondents

4.2.1 Quantitative study population (U.S.E school head teachers)

Table 7: Sociodemographic characteristics of the secondary school headteachers who participated in quantitative interviews

Variable	n (%)
Head teacher gender	
Male	137(85.6)
Female	23(14.4)
Headteacher's level of qualification	
Graduate	64 (40.0)
Postgraduate	96(60.0)
Teaching subjects	
Arts	107(66.9)
Sciences	39 (24.4)
Vocational	14(8.8)
Working experience	
5 - 15 years	24(15.0)
16 - 26 years	65(40.6)
27 to 37 years	71(44.4)
Duration as headteacher in sampled school	
< 5 years	45(28.1)
6 to 10 years	61(38.1)
11 to 16 years	32(20.0)
More than 16 years	22(13.8)

More than three quarters 137(85.6%) of the headteachers interviewed were male, with the majority of them having postgraduate education 96(60.0%). Slightly more than two thirds 107(66.9%) of the headteachers were Arts subject teachers. Almost half 71(44.4%) of the headteachers interviewed had been in the teaching profession for 27 to 37 years (mean = 25.4 years, SD = 6.37), while more than two thirds 61(38.1%) of them had been in occupancy of the office of the headteacher in the respective schools sampled, for 6 to 10 years (Mean = 8.21 years, SD = 6.8).

4.2.2 In-depth interviewees

Table 8: Sociodemographic characteristics of the secondary school headteachers who participated in in-depth interviews

In-depth interviewee number	Age	Sex	Marital status	Position in school	Duration in position (Years)
1	54	Male	Married	Headteacher	4
2	45	Male	Married	Headteacher	9
3	45	Male	Married	Headteacher	4
4	56	Female	Married	Headteacher	3
5	43	Male	Married	Deputy Headteacher	5
6	46	Male	Married	Deputy Headteacher	6
7	48	Male	Married	Deputy Headteacher	8
8	52	Male	Married	Headteacher	10
9	38	Male	Married	Headteacher	4
10	45	Male	Single	Headteacher	8
11	48	Female	Separated	Headteacher	5
12	50	Female	Married	Headteacher	7
13	56	Male	Married	Headteacher	3
14	50	Male	Married	Headteacher	3

Table 8 above shows the sociodemographic characteristics of the in-depth interviewees (school headteachers). All of the interviewees were above the age of

40 years, the majority were male and married. Most of the interviewees were headteachers, who had been occupants of that office for more than four years.

4.2.3 Key informant interviewees

Table 9: Sociodemographic characteristics of the participants who participated as Key informant interviewees.

Key informant number	Age	Sex	Marital status	Position in district education system	Duration in position
1	56	Male	Married	Inspector	5
2	54	Male	Married	D.E.O	7
3	58	Male	Married	D.E.O	8
4	45	Male	Married	Inspector	10
5	54	Male	Married	D.E.O	10
6	53	Male	Married	D.E.O	8
7	53	Female	Married	D.E.O	8
8	55	Male	Married	DEO	5
9	58	Male	Married	D.E.O	10
10	60	Female	Married	Inspector	6

As for the key informant interviewees, all of them were above the age of 50 years, and most of them were male. All the key informants were married, and had been administrators in the respective districts of their jurisdiction for more than seven years. Most of the key informants were district education officers, and had been occupying the administrative positions (education officer or inspector of schools) for more than seven years.

4.3 Assessment of technical efficiency

4.3.1 Inputs

Table 10: Distribution of U.S.E school inputs

Variable	Category	N	%
Mean enrolment	Less than 500	83	51.9
	501 - 1000	63	39.4
	1001 - 1500	11	6.9
	1501 - 2000	3	1.9
Number of class rooms	Less than 5	14	8.8
	6 - 15	09	68.1
	16 - 26	35	21.9
	More than 26	2	1.3
School land size	< 10 Acres	61	38.1
	10 - 20 Acres	70	43.8
	21 - 30 Acres	16	10.0
	More than 30 acres	13	8.1
Annual budget	< 50 million	6	3.8
	51 - 200million	19	11.9
	201 - 350 million	70	43.8
	351 - 500 million	65	40.6
PTA To teachers	< 100,000	41	25.6
	100001 - 200000	54	33.8
	200001 - 300,000	41	25.6
	300001 - 400000	14	8.8
	> 400,000	10	6.3
PLE quality intake	High (0.7 - 1)	64	40.0
	Moderate (0.5 - 0.69)	94	58.8
	Low (<0.5)	2	1.3

More than half 83(51.9%) of the U.S.E schools sampled had a mean student enrolment of less than 500 students, while more than two thirds of them 109(68.1%) had between 6 and 15 class rooms (Mean = 12.2, SD = 5.69). More than a third of the schools 70 (43.8%) were seated on land measuring between 10 and 20

Acres (Mean = 15, SD = 15.87), and were operating on annual budgets of between 201 and 350 million UGX (43.8%). Most of the schools 136 (85.0%) gave between 100,000 and 400,000 UGX as PTA to their teachers (Mean = 29115, SD = 20303) while about a third of them gave between 100001 and 200000 as PTA to students 54 (33.8%). More than half 94 (58.8%) of the schools admitted students with a moderate quality of PLE Index ranging from 0.5 to 0.69, into senior one.

4.3.2 Output

Table 11: Distribution of outputs among the sampled U.S.E schools

Variable	Category	N	%
Performance Index UCE			
	High (0.7 - 1)	5	3.1
	Moderate (0.5 - 0.69)	34	21.3
	Low (<0.5)	121	75.6

The assessment of the outputs of each school revealed that three quarters of the U.S.E schools sampled 121 (75.6%) had low output (score less than 0.5), based on their U.C.E performance index. *The Performance index measures the quality of passing at all levels of education and is computed as the (Number in Division I multiplied by 20) + (Number in Division II multiplied by 15) + (Number in Division III multiplied by 10) + (Number in Division IV multiplied by 5) + (Number in Division U multiplied by 0) all Divided by (The total that Sat UCE multiplied by 20)* (Statistical abstract, 2018.p18)

4.3.3 Returns to scale

4.3.3.1 Constant Returns to Scale

Table 12: Distribution of CRS scores

Variable	Category	N	%
CRS Score	30 - 40%	4	2.5
	41 - 50%	4	2.5
	51 - 60%	18	11.3
	61 - 70%	5	3.1
	71 - 80%	10	6.3
	81 - 90%	29	18.1
	91 - 100%	90	56.3
Minimum = 0.396, Maximum = 1.000, Mean = 0.855, S.D = 0.188			

Based on the data in table 10 above, Data Envelopment Analysis (DEA) was used to analyze the technical efficiency of each school, and it was found that, premised on the Constant Returns to Scale (CRS) output, more than half of the U.S.E schools sampled had technical efficiency scores ranging from 91 to 100%. The minimum T.E was 0.396, and the maximum was 1.000, with the mean efficiency being 0.855 and a standard deviation of 0.188.

4.3.3.2 Variable Return to Scale

Table 13: Distribution of VRS scores

Variable	Category	N	%
VRS Score	80 - 90	36	22.5
	91 - 99	20	12.5
	100%	104	65.0
Minimum = 0.822, Maximum = 1.000, Mean = 0.960, S.D = 0.058			

Based on the variable returns to scale approach of DEA, the findings in table 10 above show that nearly two thirds of the U.S.E schools 104(65%) sampled were

technically efficient. The minimum T.E was 0.822, with the maximum being 1.000, and the mean T.E being 0.960 (96%).

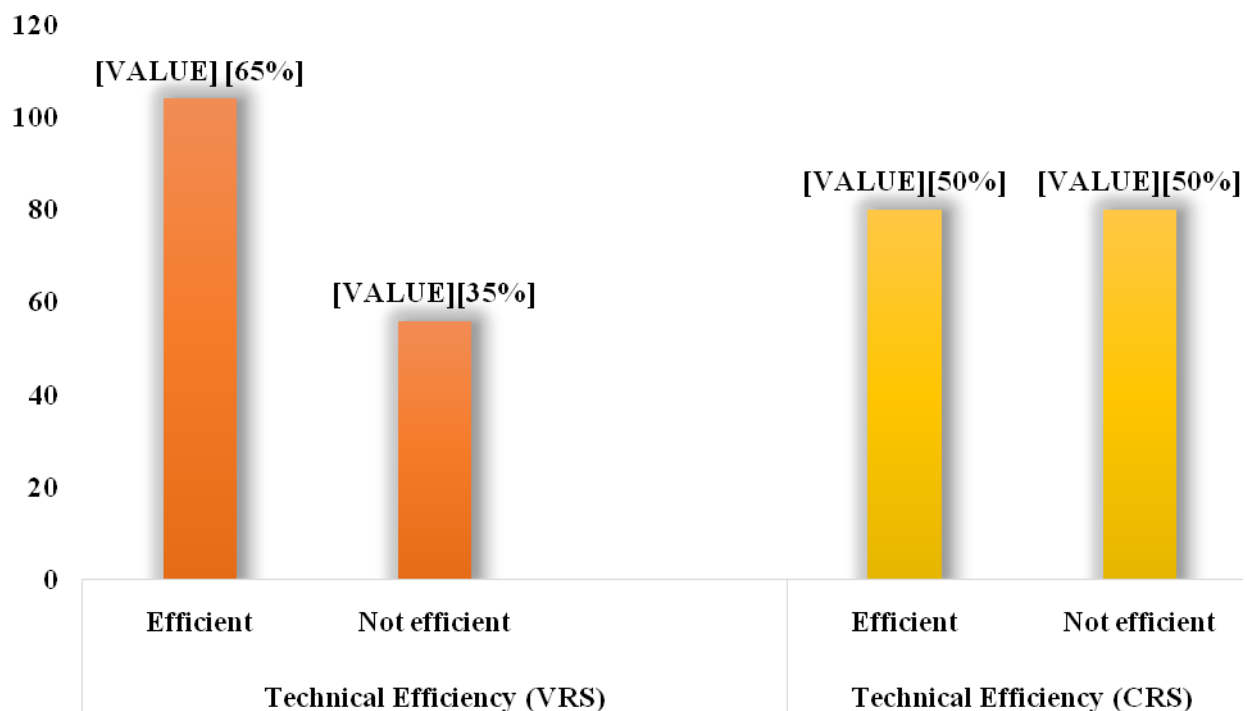


Figure 2: The proportion of universal secondary schools in Western Uganda that are technically efficient and those that were not technically efficient

Figure 2 above shows the outcome of assessment of technical efficiency of each U.S.E school, using VRS and CRS approaches of DEA. Using the VRS approach, it is shown that the level of technical efficiency in public universal secondary schools within western Uganda is 65%, while when the CRS is considered, the level of technical efficiency in public universal secondary schools within western Uganda stands at only 50%.

The exploration of technical efficiency, as it stood at U.S.E schools in western Uganda, from the perspective of both headteachers (in-depth interview) and district education system administrators (key informant), revealed three High technical efficiency emergent themes (Figure 3). These included; Fair technical efficiency (45%), (35%), and low technical efficiency (20%). However, among those three

emergent themes, one happened to stand out as most important, and that was; fair technical efficiency.

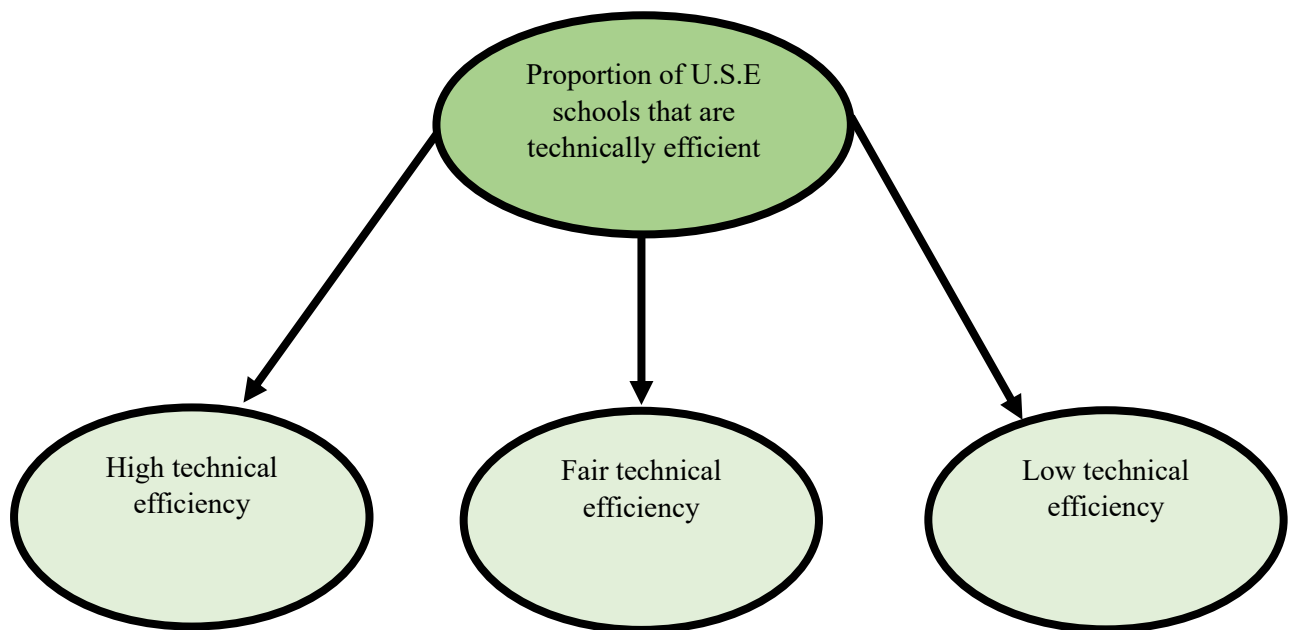


Figure 3: Thematic tree for the emergent themes from the exploration of the technical efficiency of U.S.E schools in western Uganda

One of the headteachers opined that his school was to a large extent, technically efficient, having ensured that over the previous 10 years of his occupancy of the office of the headteacher, there was improvement in resource management, and gradual improvements in efficiency.

*“ I think as a school we are technically efficient, to about 85%; I have been here for about 10 years, and in that period, I can proudly say that the performance of this school has improved gradually, even when our resources have also been on an increase. So, to a large extent, I think this school is technically efficient, and it will be better”*Headteacher, in-depth interview 4

Another headteacher declared that they had not practically assessed technical efficiency as a school, but was quick to add that taking the context of UCE performance, the school he heads was quite technically efficient. He rated their efficiency at 90%, and was optimistic that it would experience increase in 100% within the subsequent five years.

“well, I have not practically assessed the technical efficiency of this school yet, but, if you consider technical efficiency to refer to having higher outputs in terms of U.C.E performance, than inputs in terms of resources, I would say that we are quite efficient, although not universally efficient. I rate our efficiency at about 90% at least, but I am sure we shall be 100% efficient in less than five years to come” **Headteacher, in-depth interview 14**

Another headteacher opined that since they joined the U.S.E school they were heading, he had been able to streamline the financial system and general management of the school, all in the name of wanting to make sure that we put the little resources we have to good use, in order to ensure high student performance. He claimed that the school was now technically efficient enough, and actually efficient, premising his assertion on the fact that currently, the school was having more students at U.C.E getting good grades, yet the school had few resources.

“since I joined this school, I have been able to streamline the financial system and general management of the school, all in the name of wanting to make sure that we

put the little resources we have to good use, in order to ensure high student performance. So, really, this school is now efficient enough, and actually efficient, at least we now have more students at U.C.E getting good grades, given the resources that we have now. Actually, as some of our resources have increased, so have our results at O-level, which shows that we are efficient as a school. We pay fees of Shillings 150,000 and PTA of Shillings 310,000 and enrollment has increased, hence we have constructed to completion five buildings and renovated many old instructional structures”.

Headteacher, in-depth interview 8

One of the participants nearly accorded the U.S.E school they headed, 100% technical efficiency, and added that if it was not for the fact that his school was not fully utilizing the amount of resources it had, it would be fully technically efficient. According to that headteacher, the school was still efficient, the resource underutilization notwithstanding.

“ I would consider my school to be efficient at a level of about 80%, and I am saying that in the interest of not giving it 100% yet. But, I would have given it 100% if it was not for the fact that as a school we still have a lot of underutilized resources or resources that are not being put to use. Even with that situation, we still have quite high output despite of the low input, which means that we have increasing returns to scale, which we think would even be

higher if all the inputs were put to use". **Headteacher, in-depth interview 7**

Nonetheless, some few headteachers reported that their schools were not technically efficient, a case in point being a U.S.E in Fort portal city, which is situated on less than two acres of land, yet it has a very high student population and fewer teachers. The few teachers could not teach the thousands of students, which lead to low output, making the school technically inefficient.

“ My school is one of the schools that are located in Fort Portal city, located on less than two acres of land, but with an astounding population of more than 2500. So, really, given the enrollment and few teachers our output is still low at O level, because we are having thousands of students, but a small piece of land, and few teachers, who cannot teach the thousands of students, which leads to low output. So, this school is not technically efficient, because the resources are really imbalanced, some are high like students, and others are low, like land mass and teachers, which has reduced the output” **Headteacher, in-depth interview 2**

On the other hand, there were U.S.E schools which had a lot of land, but fewer students and a lot of teachers, which led to resource underutilization, and low output at U.C.E, apparently to due management issues caused by mismanagement that results from frequent change in headteachers.

“ We have enough land, but few students here, yet we have a lot of teachers. So, there is a big challenge here in resources management, which has been caused by a rampant change of headteachers. So, the resources are not being used, and so, the output is even lower, so, this school is not technically efficient” **Headteacher, in-depth interview 12**

The resource-output imbalance was further reechoed by another headteacher, whose school was inefficient, who mentioned that while the school he headed had enough resources in terms of land, and teachers, there were few students, most of whom found it hard to reach the school due long distances between home and school. Such challenges, along with other extraneous factors affected the performance of the students and hence output.

“ I think we have some resources; this school is on 10 acres of land, but there are few students and many teachers are deployed here. We receive all the required government services, but the U.C.E output is low, there are very few first grades because of a number of issues like students trekking long distances to school, on foot, and other factors. So, we have quite a number of resources as a school, but not in balance with the outputs, which means that there is no efficiency on the part of the school” **Headteacher, in-depth interview 10**

That the proportion of some U.S.E schools in western Uganda was technically efficient, that that most of them had fairly high efficiency was confirmed by all the key informants, most of who were district education officers. One of the had this to say;

“ In my opinion, the U.S.E schools in western Uganda are quite technically efficient, I am sure most of them put the capitation grants into good use, with minimal to no wastage. I am not saying that there are schools in the region that are not technically inefficient, there are there, but they are the majority, the majority are technically efficient” D.E.O Key informant interview 3

Some of them openly declared that they had not interested themselves in practically assessing the technical efficiency of the U.S.E schools within their jurisdiction, they were highly certain that the schools were fairly technical efficient.

“ technical efficiency you said?, I have not taken keen interest in assessing how technically efficient the schools in our district are, or how technically efficient the U.S.E schools in our region are, but if I am to take the interplay between inputs and outputs, I would say it is fair. At least the outputs in terms of U.C.E performance are not so bad, although for many schools they even exceed the resources the schools put in. So, the technical efficiency is fair enough” D.E.O Key informant interview 9

One D.E.O also mentioned that while they could not pin point a particular figure to represent a level of technical efficiency, because it is not out routine practice or mandate for them to assess the technical efficiency of U.S.E schools or any secondary school for that matter, he was sure that U.C.E results of the majority of the schools have been getting better by the year. That apparently informed his opinion that since the outputs of the schools were on the increase, their technical efficiency was also good enough.

“The technical efficiency of schools in my jurisdiction has increased, but please note that I cannot pin point a particular figure to represent a level of technical efficiency because it is not out routine practice or mandate to assess the technical efficiency of U.S.E schools or any secondary school for that matter. But it is not so bad I think, because the U.C.E results of the majority of the schools have been getting better by the year, which means that their outputs are increasing, in most cases, more than the resources that each school puts into its operations” D.E.O

Key informant interview 7

The high technical efficiency of U.S.E schools in western Uganda was further justified by mentioning that western Uganda was one of the most highly performing regions in Uganda, even at U.C.E. One of the key informants with such an opinion put the proportion of technical efficiency among the schools at 70%.

“well, my opinion is that we have many technically efficient secondary schools in this district, and

the region, if I am to go by the performance in U.C.E, because western Uganda is one of the topmost performing districts nationally. Some of those secondary schools include those in the U.S.E category, which because of government support have been able to have their performance improve gradually. If I am to give an estimate, out of 100, I would put the proportion of the U.C.E schools that are technically efficient in this region, at about 70% at least” Inspector,

Key informant interview 10

Another key informant, with a sentiment that the schools were fairly efficient mentioned that he knew of some U.S.E schools in his district, that had a lot of resources and I would expect them to be among the best in the country, which would show high technical efficiency, but they are not yet there. He also added that he knew of many more of the schools in that category of U.S.E schools that are really efficient, and went on to mention that going by how well the schools were using whatever resources they had and managed to produce good results at U.C.C, most of them were technically efficient.

“ I have not measured the technical efficiency of any of the U.S.E schools in my district, but, I think they are fairly technically efficient. I know of some U.S.E schools here that have a lot of resources and I would expect them to be among the best in the country, which would show high technical efficiency, but they are not yet there. Then, I know of many more of them in that category of U.S.E schools that

are really efficient, I think, going by how well they use whatever resources they have and managed to produce good results at U.C.C. Such schools are the majority in this district and the region, but still, the fact is some of them, even if they are the minority, are not yet efficient". D.E.O

Key informant interview 6

Some few key informants mentioned that there were a number of U.S.E schools that were not technically efficient, because of having a lot of resources at their disposal, but comparatively less output. When asked to put an estimate on the proportion of U.S.E schools that are not efficient, he put it to 4 in every 10.

".most of the schools in this district are underutilizing the resources that they have; most of them have enough teachers, students, funds and land, but are not having high output. The students and teachers exhibit a lot of absenteeism, which has affected their output as well. In fact, if you ask me the number of U.S.E schools that are efficient in this district, out of every 10 of them, I would say 4 of them only". Inspector, Key informant interview

Conclusion

The findings in this sub section have revealed that low output is wide spread among U.S.E schools in western Uganda, to the extent that nearly 8 in every ten of them are in the low output category. This explains why the general technical efficiency, based on the variable returns to scale approach of DEA, was found to stand at 65%, with its mean being 0.960. This leaves almost 4 in every 10 of those

U.S.E schools as technically inefficient, which is quite concerning as that translates to 104 of the 160 U.S.E schools in the region, or about 52,000 O-level students being taught in technically inefficient schools, annually.

4.4 Intrapersonal factors

Table 14a: Results of a log binomial regression of the intrapersonal factors influencing the level of technical efficiency in public universal secondary schools in western Uganda

Variable	n	%	Technical Efficiency		Estimates		Adjusted Estimates	
			Efficient [n = 104]	Not efficient [n = 56]	cPR (95% CI)	P value	aPR (95% CI)	P value
Headteacher's gender								
Male	137	85.6	86(62.8%)	51(37.2%)	0.802 (0.624 - 1.031)	0.085	0.985 (0.784 - 1.237)	0.895
Female	23	14.4	18(78.3%)	5(21.7%)	1.000		1.000	
Headteacher's level of qualification								
Graduate	64	40.0	41(64.1%)	23(35.9%)	0.976 (0.773 - 1.233)	0.840		
Postgraduate	96	60.0	63(65.6%)	33(34.4%)	1.000			
Headteacher's Teaching subjects								
Arts	107	66.9	70(65.4%)	37(34.6%)	1.018 (0.673 - 1.540)	0.934		
Sciences	39	24.4	25(64.1%)	14(35.9%)	0.997 (0.632 - 1.573)	0.990		
Vocational	14	8.8	9(64.3%)	5(35.7%)	1.000			
Working experience								
5 - 15 years	24	15.0	13(54.2%)	11(45.8%)	0.769 (0.517 - 1.145)	0.196	0.763 (0.514 - 1.132)	0.179
16 - 26 years	65	40.6	41(63.1%)	24(36.9%)	0.896 (0.705 - 1.138)	0.367	0.919 (0.722 - 1.169)	0.490
27 to 37 years	71	44.4	50(70.4%)	21(29.6%)	1.000		1.000	
Duration as headteacher in sampled school								
< 5 years	45	28.1	27(60.0%)	18(40.0%)	0.733 (0.538 - 0.999)	0.049	0.732 (0.537 - 0.997)	0.048*
6 to 10 years	61	38.1	37(60.7%)	24(39.3%)	0.741 (0.559 - 0.983)	0.038	0.730 (0.536 - 0.993)	0.045*
11 to 16 years	32	20.0	22(68.8%)	10(31.3%)	0.840 (0.619 - 1.141)	0.264	0.844 (0.620 - 1.149)	0.281
More than 16 years	22	13.8	18(81.8%)	4(18.2%)	1.000		1.000	
Apply conceptual skill of assessing the school's Strength, Weaknesses, Opportunities, and threats annually								
Always	48	30.0	28(58.3%)	20(41.7%)	0.852 (0.640 - 1.133)	0.270		
Sometimes / rarely	39	24.4	26(66.7%)	13(33.3%)	0.973 (0.742 - 1.276)	0.845		
Never	73	45.6	50(68.5%)	23(31.5%)	1.000			
Apply conceptual skill of setting Goals, Objectives or targets for the school Annually								
Always	80	50.0	49(61.3%)	31(38.8%)	0.500 (0.306 - 0.816)	0.006	1.021 (0.439 - 2.372)	0.962
Sometimes / rarely	16	10.0	8(50.0%)	8(50.0%)	0.734 (0.634 - .0851)	0.000	0.198 (0.051 - 0.767)	0.019*
Never	64	40.0	47(73.4%)	17(26.6%)	1.000		1.000	
Applies conceptual skills of scheduling activities in the school for the whole term/Year.								
Always	109	68.1	71(65.1%)	38(34.9%)	0.989 (0.763 - 1.282)	0.934		
Sometimes / rarely	10	6.3	6(60.0%)	4(40.0%)	0.911 (0.525 - 1.582)	0.741		
Never	41	25.6	27(65.9%)	14(34.1%)	1.000			
Applies conceptual skills of Reviewing the school management structure after every three years								
Always	81	50.6	53(65.4%)	28(34.6%)	1.139 (0.850 - 1.526)	0.383	1.375 (0.597 - 3.163)	0.454
Sometimes / rarely	32	20.0	24(75.0%)	8(25.0%)	1.306(0.951 - 1.793)	0.099	2.215 (0.754 - 6.508)	0.148
Never	47	29.4	27(57.4%)	20(42.6%)	1.000`		1.000	
Applies conceptual skills of								

Networking with other schools to support each other								
Always	54	33.8	33(61.1%)	21(38.9%)	0.901 (0.684 - 1.188)	0.461		
Sometimes / rarely	47	29.4	31(66.0%)	16(34.0%)	0.973 (0.742 - 1.275)	0.842		
Never	59	36.9	40(67.8%)	19(32.2%)	1.000			
Applies conceptual skills of Aligning School plans with Vision, Mission, and Core values of the school								
Always	65	40.6	40(61.5%)	25(38.5%)	0.915 (0.703 - 1.191)	0.509		
Sometimes / rarely	37	23.1	25(67.6%)	12(32.4%)	1.005 (.755 - 1.338)	0.974		
Never	58	36.3	39(67.2%)	19(32.8%)	1.000			
Applies Human relations skills of delegating staff with different management tasks in the school								
Always	39	24.4	19(48.7%)	20(51.3%)	0.838 (0.556 - 1.262)	0.398	0.908 (0.355 - 2.324)	0.840
Sometimes / rarely	78	48.8	60(76.9%)	18(23.1%)	1.323 (0.999 - 1.753)	0.051	2.914 (1.214 -6.991)	0.017*
Never	43	26.9	25(58.1%)	18(41.9%)	1.000		1.000	
Applies Human relations skills of Holding informal conversations with teaching staff								
Always	88	55.0	50(56.8%)	38(43.2%)	0.745 (0.591 - 0.939)	0.013	0.355 (0.158 - 0.799)	0.012*
Sometimes / rarely	13	8.1	9(69.2%)	4(30.8%)	0.908 (0.615 - 1.340)	0.626	0.465 (0.110 - 1.961)	0.297
Never	59	36.9	45(76.3%)	14(23.7%)	1.000		1.000	
Applies Human relations skills of Holding informal conversations with non- teaching staff								
Always	81	50.6	54(66.7%)	27(33.3%)	1.043 (0.817 - 1.330)	0.736		
Sometimes / rarely	18	11.3	11(61.1%)	7(38.9%)	0.956 (0.632 - 1.446)	0.831		
Never	61	38.1	39(63.9%)	22(36.1%)	1.000			

Descriptively, almost half of the headteachers 73[45.6%] reported that they never applied conceptual skills of assessing the school's Strength, Weaknesses, Opportunities in their regular management systems, although half of the headteachers 80[50.0%] always applied conceptual skills of setting Goals, Objectives or setting targets for the school, annually. More than two thirds of the headteachers reported that they always applied conceptual skill of scheduling activities in the school for the whole term/Year, while half of them 81[50.6%] reported that they always applied conceptual skill of reviewing the school's management structure after every three years.

Findings in table 11a above show that three intrapersonal characteristics had a significant relationship with technical efficiency of the U.S.E school, at bivariable level, and those included the duration as headteacher in sampled school (cPR =

0.733 [95% CI = 0.538 - 0.999], $P = 0.049$), application of conceptual skill of setting Goals, Objectives or targets for the school (cPR = 0.734 [95% CI = 0.634 - .0851], $P = 0.000$), and the application of Human relations skills of Holding informal conversations with teaching staff (cPR = 0.745 [95% CI = 0.591 - 0.939], $P = 0.013$).

However, following adjustment for confounders at multivariable level, it was found that an additional intrapersonal characteristic became statistically significant, and was the application of human relations skills of delegating staff with different management tasks in the school. The adjusted findings show that the prevalence of technical efficiency was less by 27% at schools whose headteachers had been in occupancy of their respective office for < 5 years (aPR = 0.730[95% CI = 0.536 - 0.993], $p = 0.045$) compared to those who had been headteacher for more than 16 years. The prevalence of technical efficiency was less by 80% (aPR = 0.198 [95% CI = 0.051 - 0.767], $p = 0.019$) at U.S.E schools whose headteachers who sometimes / rarely applied conceptual skill of setting Goals, Objectives or targets for the school, compared to those who never did so.

However, technical efficiency was twice as high at U.S.E schools whose head teachers who sometimes / rarely applied human relations skills of delegating staff with different management tasks in the school (aPR = 2.914 [95% CI = 1.214 - 6.991], $p = 0.017$) compared to those who never did so. The prevalence of technical efficiency was less by 64% at U.S.E schools whose head teachers always applied human relations skills of holding informal conversations with teaching staff (aPR = 0.355 [95% CI = 0.158 - 0.799], $p = 0.012$) compared to those who never applied human relations skills of holding informal conversations with teaching staff.

Table 15b: Continuation of a log- binomial regression on additional intrapersonal factors influencing the level of technical efficiency

Variable	n	%	Technical Efficiency		Estimates		Adjusted Estimates	
			Efficient [n = 104]	Not efficient [n = 56]	cPR (95% CI)	P value	aPR (95% CI)	P value
Applies Human relations skills of Handling disputes among staff as soon as possible								
Always	71	44.4	39(54.9%)	32(45.1%)	0.777 (0.594 - 1.016)	0.065	0.447 (0.191 - 1.046)	0.063
Sometimes / rarely	31	19.4	24(77.4%)	7(22.6%)	1.095 (0.851 - 1.409)	0.480	1.286 (0.425 - 3.894)	0.656
Never	58	36.3	41(70.7%)	17(29.3%)	1.000		1.000	
Applies Human relations skills of Participating in Social and Community Events								
Always	36	22.5	22(61.1%)	14(38.9%)	0.999 (0.769 - 1.297)	0.994		
Sometimes / rarely	64	40.0	46(71.9%)	18(28.1%)	0.891 (0.664 - 1.197)	0.445		
Never	60	37.5	36(60.0%)	24(40.0%)	1.000			
Applies Technical skills, to weekly supervise subordinates (support Supervision)								
Always	48	30.0	30(62.5%)	18(37.5%)	0.790 (0.608 - 1.028)	0.079	1.113 (0.476 - 2.601)	0.806
Sometimes / rarely	42	26.3	28(66.7%)	14(33.3%)	0.795 (0.605 - 1.045)	0.100	0.921 (0.368 - 2.307)	0.860
Never	70	43.8	46(65.7%)	24(34.3%)	1.000		1.000	
Apply Technical skills to weekly walk around the school, see ongoing work activities, conditions of facilities and act								
Always	32	20.0	19(59.4%)	13(40.6%)	0.874 (0.637 - 1.198)	0.402		
Sometimes / rarely	25	15.6	15(60.0%)	10(40.0%)	0.883 (0.624 - 1.248)	0.481		
Never	103	64.4	70(68.0%)	33(32.0%)	1.000			
Applies Technical skills, to Operate using the school action plan that guides completion of school programmes								
Always	18	11.3	10(55.6%)	8(44.4%)	0.891 (0.567 - 1.401)	0.618		
Sometimes / rarely	73	45.6	51(69.9%)	22(30.1%)	1.121 (0.884 - 1.421)	0.345		
Never	69	43.1	43(62.3%)	26(37.7%)	1.000			
Applies Technical skills, to Customise the national curriculum to fit the school departmental levels								
Always	25	15.6	10(40.0%)	15(60.0%)	0.569 (0.343 - 0.943)	0.029	0.363 (0.125 - 1.050)	0.061
Sometimes / rarely	71	44.4	49(69.0%)	22(31.0%)	0.982 (0.786 - 1.226)	0.870	0.944 (0.418 - 2.133)	0.891
Never	64	40.0	45(70.3%)	19(29.7%)	1.000		1.000	
Applies Technical skills, to set guidelines to monitor students' termly performance								
Always	22	13.8	9(40.9%)	13(59.1%)	0.583 (0.347 - 0.982)	0.043	0.349 (0.123 - 0.992)	0.048*
Sometimes / rarely	51	31.9	34(66.7%)	17(33.3%)	0.951 (0.750 - 1.206)	0.677	0.672 (0.297 - 1.517)	0.338
Never	87	54.4	61(70.1%)	26(29.9%)	1.000		1.000	
Applies Technical skills, to Carry out staff skills needs assessment								
Always	8	5.0	5(62.5%)	3(37.5%)	0.996 (0.559 - 1.774)	0.989		
Sometimes / rarely	101	63.1	67(66.3%)	34(33.7%)	1.057 (0.821 - 1.362)	0.666		
Never	51	31.9	32(62.7%)	19(37.3%)	1.000			
Applies Technical skills, to carry out professional development workshops								
Always	16	10.0	6(37.5%)	10(62.5%)	0.471 (.247 - 0.898)	0.022	0.140 (0.036 - 0.542)	0.004*
Sometimes / rarely	85	53.1	51(60.0%)	34(40.0%)	0.753 (.607 - 0.935)	0.010	0.188 (0.073 - 0.484)	0.001*
Never	59	36.9	47(79.7%)	12(20.3%)	1.000		1.000	
Applies Technical skills, to Conduct individual teachers evaluation of performance termly								
Always	17	10.6	6(35.3%)	11(64.7%)	0.471 (0.242 - 0.914)	0.026	0.249 (0.071 - 0.868)	0.029*
Sometimes / rarely	95	59.4	62(65.3%)	33(34.7%)	0.870 (0.699 - 1.084)	0.214	0.721 (0.318 - 1.635)	0.433
Never	48	30.0	36(75.0%)	12(25.0%)	1.000		1.000	

In table 11b above a continuation of the findings that were obtained from the analysis of intrapersonal factors associated with technical efficiency is shown. The findings show that almost half of the head teachers reportedly always applied Human relations skills of Handling disputes among staff as soon as possible 71[44.4%], while more than a third of them 64 [40.0%] sometimes applied human relations skills of participating in Social and Community events, but never applied technical skills, to weekly supervision of subordinates (support Supervision) 70[43.8%].

Close to two thirds of the head teachers 103[64.4%] never applied technical skills, to weekly walk around the school to see ongoing work activities and conditions of the facilities and taking requisite actions. Almost half of the headteachers 73[45.6%] rarely applied Technical skills, to Operate using the school action plan that guides completion of school programmes, and rarely applied Technical skills, to Customize the national curriculum to fit the school departmental levels 71[44.4%].

More than half of the head teachers 87[54.4%] reported that they never applied technical skills, to set guidelines to monitor students' termly performance, while the majority 101[63.1%] rarely applied technical skills, to Carry out staff skills needs assessment, and rarely applied technical skills, to carry out professional development workshops 85[53.1%]. More than half of the respondents 95[59.4%] reported that they sometimes applied technical skills, to conduct individual teachers' evaluation of performance termly.

Four extra intrapersonal characteristics were found to have significant associations with technical efficiency, at bivariable level and those were; application of

technical skills, to set guidelines to monitor students' termly performance (cPR = 0.583 [95% CI = 0.347 - 0.982], P = 0.043), application of technical skills, to carry out professional development workshops (cPR = 0.471 [0.247 - 0.898], p = 0.022), and application of technical skills, to Conduct individual teachers evaluation of performance termly (cPR = 0.471 [95% CI = 0.242 - 0.914], P = 0.026), and application of technical skills, to customize the national curriculum to fit the school departmental levels (cPR = 0.569 [95% CI = 0.343 - 0.943], P = 0.029).

However, when the four variables were adjusted in a single multivariable log-binomial model, only three remained significant in their association with technical efficiency. The findings showed that technical efficiency was less by 65% at U.S.E schools whose headteachers applied technical skills, to set guidelines to monitor students' termly performance (aPR = 0.349 [95% CI = 0.123 - 0.992], P = 0.048) compared to those never applied technical skills, to set guidelines to monitor students' termly performance.

The prevalence of technical efficiency was less by 86% at U.S.E schools whose headteachers always applied technical skills, to carry out professional development workshops (aPR = 0.140 [95% CI = 0.036 - 0.542], P = 0.004) compared to those who never applied technical skills, to carry out professional development workshops.

The prevalence of technical efficiency was less by 75% at U.S.E schools whose head teachers always applied technical skills, to Conduct individual teachers' evaluation of performance termly (aPR = 0.249 [95% CI = 0.071 - 0.868], P = 0.029) compared to those who never applied technical skills, to Conduct individual teachers' evaluation of performance termly.

Qualitative findings

From the qualitative investigation of the intrapersonal factors using thematic analysis (through manually organized codes) that are influencing the technical efficiency, five major emergent themes relevant to the study were identified. They included; headteacher's general experience in managing secondary schools, very short power distance creation tendency, human resource managerial practices, financial managerial practices, and headteacher's experience in a given U.S.E school (Figure 4). The thematic analysis revealed that, all the aforementioned emergent themes were important and universally concurred with all the significant factors that were identified from the quantitative analysis (Table 11a and Table 11b).

Much as in tables 11a and b, not all the themes from the thematic analysis were factors quantitatively assessed, it is clearly evident that, they are supportive of the study in general and scope of the investigation was enlarged to understand other factors that affect Technical efficiency as the systems theory postulates. Such factors included, financial managerial practices, very short power distance creation tendency (which relates more with holding informal meetings with staff and human relations skills) that were already significant during the quantitative analysis.

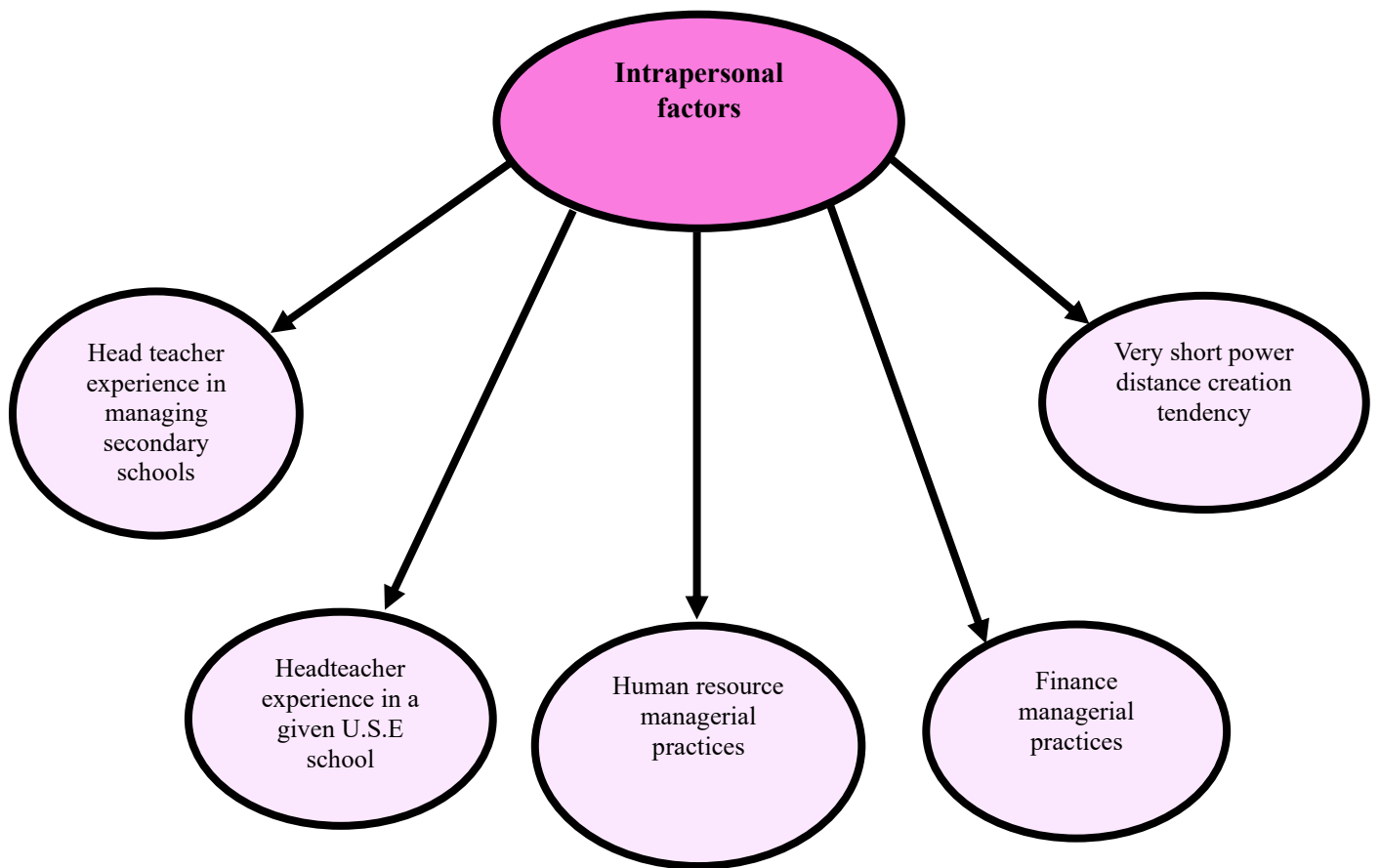


Figure 4: Thematic tree for the emergent themes from the exploration of the intrapersonal factors influencing technical efficiency in U.S.E schools in western Uganda

Head teacher experience in managing secondary schools

Headteacher experience in being a headteacher was arguably the most mentioned intrapersonal factor that apparently influenced technical efficiency of U.S.E schools in western Uganda. It was mentioned by almost all the headteachers and all the key informants as being one of the most important factors that was influencing technical efficiency at U.S.E schools in western Uganda. Head teacher experience was so important that to some qualitative study participants, it was the most important factor that mattered.

“ of course, there are many personal characteristics of the headteacher that can influence the technical efficiency of the schools they head, and those can include their own demographic characteristics like sex and age. But, for me I think that such characteristics do not matter a lot or if they do matter, then they are not as significant as the experience of the headteacher. The effect of experience in the headteachers office could perhaps be more significant when it is applied to the U.S.E schools. What I mean is that while headteacher experience is significant, generally, if the experience is substantial in a U.S.E school, the effect on technical efficiency can even be higher. For example, for me I have about seven years of experience in managing a U.S.E school, and I believe that is one of the reasons why my school is at least technically efficient, better than some schools headed by headteachers who are less experienced in managing a U.S.E school or newly appointed and posted”.

Headteacher, in-depth interview 8

One of the participants was also of the view that personal experience in the headteachers office is the only intrapersonal characteristic of headteachers of U.S.E schools that mattered most. He premised his opinion on experienced headteachers managing resources of the schools they are deployed to better, and ensure lower wastage of them, while pushing for good outcomes.

“Personal experience in the headteachers office is what is the most significant characteristic that can make a difference between a U.S.E school being technically efficient or not. Experienced headteachers can, in many cases, manage the resources of the schools they are deployed to better, and ensure lower wastage of them, while pushing for good outcomes. I am a living example of that, I have quite some experience as a headteacher, and that has helped me use all the resources optimally to achieve our goals and our School has greatly improved, which I set my self and make my staff try as much as possible to achieve them”.

Headteacher, in-depth interview 8

The same was reiterated by a deputy headteacher of one of the U.S.E schools, who thought that no intrapersonal characteristic of the headteachers of U.S.E schools in the western region or any region for that matter, could beat practical experience in the office of the headteacher, when it came to matters of determining technical efficiency.

“.in my opinion, if you ask me, I think no intrapersonal characteristic of the headteachers of U.S.E schools in the western region or any region for that matter, beats practical experience in the office of the headteacher. The number of year that a given head teacher has spent being at the helm of managing secondary schools or simply as a headteacher matters most, because the longer the

experience as a headteacher, the more likely that the headteacher will be excellent at managing all kinds of resources in the schools they are deployed in, and hence the more likely the schools they head will be in position to achieve the best of outcomes. So, in summary, more experienced headteachers are more likely to foster high technical efficiency at the schools they head” Deputy Headteacher, in-depth interview 5

Another key informant, a D.E.O, was also of the same view, mentioning that it is the experience of the headteacher, in secondary school management that is the most important personal characteristics of a headteacher, that can make them drive the school towards technical efficiency or not

“.it is the experience of the headteacher, in secondary school management; I think it is one of the most important personal characteristics of a headteacher, that can make them drive the school towards technical efficiency or not. If a headteacher is experienced enough, their odds of managing the school well, handling school resources well and ensuring that students are well taught are higher. However, it is possible to have a fresh headteacher with less than five years of experience in that position, make significant positive changes in the management system, and move the schools they manage, to greatness in a short time, better than some experience ones”. D.E.O Key informant interview 9

While general experience of a headteacher in managing a given school was one of the most important intrapersonal characteristics that were mentioned as being important was the experience of a headteacher in the office of the headteacher in a given school. Almost all key informants agreed that the number of years spent in managing a given school, by the headteacher, influenced the technical efficiency of that schools, performance more.

*“ Like I mentioned earlier, experience as a headteacher is the most important intrapersonal factor that can influence the technical efficiency of any secondary school, no question about that. However, to be precise, the effect of that experience on technical efficiency becomes even more important when the experience garnered is in a given school. A headteacher who has 15 years’ experience in managing various schools may not be as effective in fostering technical efficiency as one who has 10 years’ experience in managing a single given school, because they will be used to every single system detail in that given school, and will be able to set their own systems that can prove to be sustainably effective”***Headteacher in-depth interview 8**

To one of the headteachers, experience as a headteacher of a given U.S.E school outweighed most other intrapersonal characteristics because, according to him, it is the experience in a given school that increases knowledge of how to solve any issues in that school, manage all resources, and also that one can have enough

time to set goals or a system that they can sustain and ensure that it works towards bettering the school they head

“To me, it is experience as a headteacher of a given U.S.E school because the experience in a given school increases knowledge of how to solve any issues in that school, manage all resources, and also, one can have enough time to set goals or a system that they can sustain and ensure that it works towards bettering the school they head. So, in my opinion, headteacher experience in a given U.S.E school is what can count most, instead of just long experience as a headteacher in secondary schools”. **Headteacher, in-depth interview 14**

Human resource managerial practices

Besides the experience of the headteacher, the human resource management practices of a given headteacher were also considerably highlighted. One of the in-depth interviewees mentioned that headteachers are actually leaders, who have to lead a large team of different categories of people to greatness, which in a secondary school context, includes achieving high performance, through use of particular managerial practices. It is such practices that can then guarantee technical efficiency.

“. Head teachers are managers of schools, they manage school resources including infrastructure, teachers, finances and students, all to achieve certain goals. So, as managers, headteachers like men are actually leaders, who

have to lead a large team of different categories of people to greatness, which in a secondary school context, includes achieving high performance, through use of particular managerial practices, perhaps the most important of which include providing guidance and direction to all subordinates. That is what we call having a vision, mission and setting goals for the school one leads, and targets that each teacher must work towards fulfilling or achieving. If any headteacher doesn't have that much charisma and transformational styles of leadership and management, the output of their school is affected, and there cannot be anything like technical efficiency". Headteacher, in-depth interview 3

Confirmation of the imperativeness of management practices of headteachers in driving technical efficiency of each U.S.E was further provided by most of the district education officers, one of whom was of the view that as D.E.Os, they leave all issues of school management to headteachers. He said that as overseers of the education system at district level, they do not involve themselves in micromanaging headteachers or their schools, expecting that each of the headteachers has sufficient managerial and leadership skills and practices to ensure that their schools are well managed and led.

". For us as overseers of the education system at district level, we are not supposed to micromanage headteachers or their schools, each of the headteachers should have sufficient managerial and leadership skills and

practices to ensure that their schools are well managed and led. It is headteachers that must ensure that each of the resources put in their management, including land, building, vehicles, students, and funds are well utilized in order to have the school perform. So, if the headteachers mismanages the school through embezzlement of funds, underuse of resources, demotivation of staff and students, absenteeism, then there cannot be efficiency. Therefore, I think that management skills and experience are the most important or the only important intrapersonal factor on the level of the headteacher, that matters in secondary school technical efficiency. In my opinion, the other intrapersonal characteristics simply confound managerial practices applied by the headteacher".DEO, key informant interview 4

Financial managerial practices

The financial management practices of headteacher at U.S.E schools were also largely highlighted as key intrapersonal characteristics of headteachers, that could make a difference in whether a school is technically efficient or not. This was a stand held by both in-depth interviewees and key informant interviewees. One of the headteachers mentioned that he knew that technical efficiency has a lot to do with financial management, on the part of the headteacher and thought that the difference between having a school as technically efficient and not being technically efficient depends on the financial management practices of the headteachers

“ I know that technical efficiency has a lot to do with financial management, on the part of the headteacher and I think that the difference between having a school as technically efficient and not being technically efficient depends on the financial management practices of the headteachers. That is because in U.S.E schools like the one I manage here, we receive capitation grants from government, which are not so sufficient to have the school implement all programs in a way that a headteacher would love to have them implemented. Therefore, any fund mismanagement, through using the funds in non-relevant programs, or embezzlement can affect the entire school system, starting with demoralizing staff, and then reducing the output of the school. As a headteacher, I endeavor to use the little funds given to us as amicably as possible to avoid such circumstances, and have the funds used to achieve as much output as possible through our students performance”.

Head teacher, In-depth interview 11

A key informant had the same sentiment, highlighting that resource management, including inputs like finances was an important trait by headteachers, that can ensure technical efficiency, if managed well.

“ you know, technical efficient is largely founded on how well resource management is done, that is, how well the inputs are used by the person mandated to manage those

inputs. So, to me, one of the most important resources that the headteacher in a U.S.E school should manage well, short of which there cannot be efficiency, are the finances. It is financial management that governs the running of all other resources, this has been severally proven over the years. So, if a headteacher does not put the millions in their budget to good use, through full use and no cases of misallocation, corruption, inflated procurements, then we expect that the school he/she manages will have good outputs, by all means”DEO, key informant interview 7

Very short power distance creation tendency

Some few headteachers highlighted the importance of the distance between staff and headteachers, which in management, is referred to as power distance. Their view was that, while it is okay for a headteacher to be as close as possible to his teaching staff, there is no harm in that, but, it can be dangerous if the distance between the headteacher and the teachers is too short or if it is non-existent to the extent that the headteachers engage with their teachers so casually, all the time. According to the headteachers with such a view, such a short power distance can prove to have a negative effect on the efficiency of a school, due to a high risk of work deviance by teachers in such a school.

“The other factor that is not so much talked about as being important in determining school performance and technical efficiency is how familiar the headteacher and how free he is with his teaching staff, and even non-teaching staff. It is okay

for a headteacher to be as close as possible to his teaching staff, there is no harm in that, but, it can be dangerous if the distance between the headteacher and the teachers is too short or if it is non-existent to the extent that the headteachers engage with their teachers so casually, all the time. That can increase risk of work place deviance on the part of the teachers, who can find it very easy to engage in absenteeism, which is a big challenge in some U.S.E schools by the way, and it has reduced their efficiency". **Head teacher, In-depth interview 8**

Conclusion

Intrapersonal factors of the respective headteachers of U.S.E schools in western Uganda are important factors associated with their technical efficiency. Seven of them are associated with technical efficiency, and they include the management practice of applying human relations skills of delegating staff with different management tasks in the school, occupancy of the headteachers role for < 5 years, rare application of the conceptual skill of setting goals, objectives or targets for the school by headteachers, application of human relations skills of holding informal conversations with teaching staff, application of technical skills, to set guidelines to monitor students' termly performance, application of technical skills, to carry out professional development workshops. That is in to the application of technical skills, to conduct individual teachers' evaluation of performance termly, and rare application of human relations skills of delegating staff with different management tasks in the school. Among all these variables, only the rare application of human relations skills of delegating staff with different management

tasks in the school happened to be protective of technical efficiency, the rest were its antagonists.

4.5 Institutional factors

Table 16: Results of the Log-binomial regression on the institutional factors influencing the level of technical efficiency in public universal secondary schools within western Uganda

Variable	n	%	Technical Efficiency		Crude Estimates		Adjusted Estimates	
			Efficient [n = 104]	Not efficient [n = 56]	cPR (95% CI)	P value	aPR (95% CI)	P value
Region of location								
Ankole	60	37.5	38(63.3%)	22(36.7%)	1.108 (0.762 - 1.611)	0.590		
Rwenzori	42	26.3	27(64.3%)	15(35.7%)	1.125 (0.760 - 1.665)	0.556		
Bunyoro	30	18.8	23(76.7%)	7(23.3%)	1.342 (0.921 - 1.955)	0.126		
Kigezi	28	17.5	16(57.1%)	12(42.9%)	1.000			
Founding body								
Anglican	84	52.5	52(61.9%)	32(38.1%)	0.774 (0.484 - 1.237)	0.284		
Catholic	32	20.0	21(65.6%)	11(34.4%)	0.820 (0.495 - 1.359)	0.442		
Government	39	24.4	27(69.2%)	12(30.8%)	0.865 (0.532 - 1.406)	0.560		
UMSC	5	3.1	4(80.0%)	1(20.0%)	1.000			
Mean enrolment								
Less than 500	83	51.9	54(65.1%)	29(34.9%)				
501 - 1000	63	39.4	40(63.5%)	23(36.5%)				
1001 - 1500	11	6.9	7(63.6%)	4(36.4%)				
1501 - 2000	3	1.9	3(100.0%)	0(0.0%)				
School land size								
< 10 Acres	61	38.1	35(57.4%)	26(42.6%)	0.829 (0.543 - 1.264)	0.383		
10 - 20 Acres	70	43.8	48(68.6%)	22(31.4%)	0.990 (0.667 - 1.471)	0.962		
21 - 30 Acres	16	10.0	12(75.0%)	4(25.0%)	1.083 (0.684 - 1.716)	0.733		
More than 30 acres	13	8.1	9(69.2%)	4(30.8%)				
Annual budget								
< 50 million	6	3.8	5(83.3%)	1(16.7%)	1.128 (0.767 - 1.660)	0.539	1.600 (0.172 - 14.910)	0.680
51 - 200million	19	11.9	13(68.4%)	6(31.6%)	0.927 (0.661 - 1.299)	0.658	0.683 (0.202 - 2.303)	0.539
201 - 350 million	70	43.8	38(54.3%)	32(45.7%)	0.735 (0.567 - 0.953)	0.020*	0.439 (0.207 - 0.930)	0.032*
351 - 500 million	65	40.6	48(73.8%)	17(26.2%)	1.000		1.000	
PTA To teachers								
10000 - 40,000 Ugx	136	85.0	92(67.6%)	44(32.4%)				
40,100 - 70,000 Ugx	17	10.6	5(29.4%)	12(70.6%)				
70100 - 100,000 Ugx	7	4.4	7(100.0%)	0(0.0%)				
Teacher enrolment								
< 10 Teachers	19	11.9	15(78.9%)	4(21.1%)	1.316 (0.886 - 1.954)	0.174	3.309 (0.761 - 14.388)	0.111
10 - 20 teachers	79	49.4	49(62.0%)	30(38.0%)	1.034 (0.719 - 1.487)	0.858	1.393 (0.519 - 3.738)	0.510
21 - 30 Teachers	37	23.1	25(67.6%)	12(32.4%)	1.126 (0.762 - 1.664)	0.551	1.515 (0.494 - 4.649)	0.467
More than 30 teachers	25	15.6	15(60.0%)	10(40.0%)	1.000		1.000	
PLE quality intake								
High (0.7 - 1)	64	40.0	46(71.9%)	18(28.1%)				
Moderate (0.5 - 0.69)	94	58.8	56(59.6%)	38(40.4%)				
Low (<0.5)	2	1.3	2(100.0%)	0(0.0%)				
Adequacy of resources								
Adequate	65	40.6	40(61.5%)	25(38.5%)	0.913 (0.720 - 1.159)	0.456		
Inadequate	95	59.4	64(67.4%)	31(32.6%)	1.000			
Parent involvement								
Adequate	54	33.8	35(64.8%)	19(35.2%)	0.972(0.678 -1.394)	0.878		
Low	85	53.1	55(64.7%)	30(35.3%)	0.971(0.690 - 1.365)	0.864		
Very low	21	13.1	14(66.7%)	7(33.3%)	1.000			
Location status								
Urban	15	9.4	11(73.3%)	4(26.7%)	1.144 (0.816 - 1.604)	0.434		
Semi-urban	42	26.3	27(64.3%)	15(35.7%)	1.003 (0.768 - 1.311)	0.981		
Rural	103	64.4	66(64.1%)	37(35.9%)				
Energy source								
Electricity / generator	88	55.0	62(70.5%)	26(29.5%)	1.208 (0.952 - 1.532)	0.119	2.074 (1.031 - 4.171)	0.041*
Solar	72	45.0	42(58.3%)	30(41.7%)	1.000		1.000	
Water source								
Tap water	92	57.5	62(67.4%)	30(32.6%)	1.161 (0.833 - 1.616)	0.378		
Borehole / well	37	23.1	24(64.9%)	13(35.1%)	1.117 (0.763 - 1.636)	0.570		
Rain	31	19.4	18(58.1%)	13(41.9%)	1.000			

At Univariate analysis, slightly more than half of the U.S.E. schools sampled had a mean enrollment of fewer than 500 students (83 [51.9%]), while more than a third of them had a school land size ranging from 10 to 20 acres (70 [43.8%]) and an annual budget between 201 and 350 million Ugx (70 [43.8%]). More than three quarters of the respondents provided between 100,000 and 400,000 Ugx as PTA to teachers (136 [85.0%]). Almost half of the headteachers (79 [49.4%]) had an enrollment of between 10 and 20 teachers, and the majority of them (94 [58.8%]) reported a moderate PLE quality intake (0.5 - 0.69). The majority of the schools (95 [59.4%]) reportedly had inadequate resources and exhibited low parental involvement in school affairs (85 [53.1%]). Nearly two-thirds (103 [64.4%]) of the respondents were located in rural areas, while the majority used electricity or generators as their energy source (88 [55.0%]) and tap water as their water source (92 [57.5%])

At bivariate level, only one institutional characteristic showed statistical significance, and this was the annual budget of the school (cPR = 0.735 [0.567 - 0.953], $p = 0.020$). However, at multivariate analysis, one more characteristic emerged as significant, and that was the energy source used at the U.S.E school. The prevalence of technical efficiency was less by 79% in U.S.E schools whose annual budget ranged from 201 to 350 million (aPR = 0.439, $p = 0.032$) compared to those whose annual budget ranged between 351 and 500 million. In addition, the prevalence of technical efficiency was twice as high at U.S.E schools which used electricity / generator as their energy source (aPR = 2.074, $p = 0.041$) compared to schools which used solar energy.

Conclusion

The study identified key factors influencing the technical efficiency of Universal Secondary Education schools in western Uganda. It highlighted the significance of institutional characteristics, particularly the annual budget and energy sources, in enhancing operational efficiency. By understanding these elements, stakeholders can make informed decisions to improve educational outcomes and resource management within these schools. The findings underscore the importance of addressing both financial and infrastructural aspects to foster a more effective educational environment. Future research could further explore additional variables that may impact efficiency and develop targeted interventions to support schools in maximizing their potential.

CHAPTER FIVE:

DISCUSSION OF FINDINGS

5.1 The level of technical efficiency in public universal secondary schools within western Uganda

Given that, secondary school education is one of the most important pathways to achieving sustainable development goal 4 (UNICEF, 2024; UNESCO, 2024) and hence global sustainable development, cannot be overstated (World Bank group, 2024; UNESCO, 2024; Ainscow, 2020; Bamberger and Kim, 2022). Thus, secondary schools have been built and setup globally, to increase access to secondary education. However, while that is laudable, having secondary schools set up and increase in access to secondary-level education increased, is not an end in its self. The schools set up ought to be technically efficient, if the goals of education (as enshrined in goal 4) are to be achieved. Thus, it can be asserted at this point that high technical efficiency of any secondary school is perhaps the most important protagonist of its performance, and hence the performance of its students. However, while that is the outright case, previous assessments of technical efficiency, in many countries, has revealed that technical efficiency is not universal among secondary schools, and even not optimal (not more than 80%) in a considerable a number of schools. That much was true in the context of universal secondary education schools in western Uganda. The findings of this study revealed that, based on the VRS approach, the level of technical efficiency in public universal secondary schools within western Uganda is 65%, while when the CRS approach is considered, the level of technical efficiency of the U.S.E schools is only 50%.

Those findings imply that about 7 in every 10 of the U.S.E schools in western Uganda are technically efficient, taking the perspective of inputs resulting into a change in output, either negatively or positively (VRS). In other words, about 7 in every 10 U.S.E schools produce more output than the inputs they receive annually (having an increasing return to scale [IRS]), which also implies that about 3 in every 10 U.S.E schools in the region produce less output than the inputs they receive annually (have a decreasing return to scale [DRS]). While that can be considered to be fair technical efficiency, it gets worse when the CRS is considered; only 5 in every 10 of the U.S.E schools can produce an equal amount of output, for every amount of input. What is surprising is that the level of technical efficiency of the U.S.E schools in western Uganda is higher, or at the very least, comparable to the technical efficiency of secondary schools in Europe.

It should be recalled that most studies that have been conducted over the past 10 years, to assess the technical efficiency of secondary schools are contextual to Europe. That notwithstanding, the technical efficiency of secondary schools (U.S.E) in western Uganda is higher than what has been reported in countries like Malta, the United Kingdom, Slovakia, the Netherlands, Denmark, Bulgaria, Cyprus, Croatia, Latvia, Lithuania, Luxembourg, Romania, and Hungary (Ifigeneia-Dimitra and Stylianos, 2021), in which the mean technical efficiency was 0.933, yet western Uganda, it was 0.960. The level of technical efficiency of schools in western Uganda is also higher than what was reported in Greece by Sotiriadis et al. (2018) (VRS mean 0.834), Margaritis et al. (2022) in Greece (VRS mean = 0.936), Provazníková and Chlebounová (2018) in Czech republic (25%), Chlebounová (2019) in Czech republic (33%). Technical efficiency of U.S.E schools in western Uganda is still higher than what was reported by Rohayana (2018) in Indonesia (32.4%, with

the mean of 0.936), Huguenin (2015) in Switzerland, Geneva (VRS mean 0.93)Nauzeer et al. (2018) in Mauritius (VRS mean 0.872) and, Yahia and Essid (2019) in Tunisia (3.5%).

Thus, going by the additional fact that mean technical efficiency of the U.S.E schools in western Uganda was 0.960 with the VRS, it can be said that the level of technical efficiency those schools is better than what is the case in schools within the global north. Such schools would ideally have been expected to be significantly more efficient than those in the global south (Low- and middle-income countries) where Uganda is situated, because of the higher economic indices in the global north, better technology and even better inputs (Langthaler and Malik, 2023; UNESCO, 2022; Kunibert et al., 2022; Hickel et al., 2022; Rambaldi, 2022; Roberts and Tran, 2023). That was not the case however, and the differences in findings can be explained on one front, and that is that none of the schools in Europe, Mauritius, Indonesia or Tunisia were under an arrangement similar to that of U.S.E schools. Most of the countries that reported lower technical efficiency were in countries that do not provide free secondary education. Even in countries like Czech republic and Greece where secondary education is totally free, the arrangement is also very different from that of U.S.E schools in Uganda, the students and their parents in those two countries face no burden at all in input resources.

Therefore, by being in economically more developed regions, and not providing free education, with resources in free secondary education schools being fully catered for by the respective states, it is highly certain that in schools within countries that reported lower technical efficiency, there was comparatively

significantly more input. That was to the extent that it exceeded the amount of input, in terms of physical and monetary resources, that is U.S.E schools in western Uganda. That difference implies that in the global north, the number of inputs into the secondary schools were more likely to exceed the output of the schools therein, in terms of student performance and productivity. This also means that the odds of the secondary schools in Malta, the United Kingdom, Slovakia, the Netherlands, Greece, Czech republic, Tunisia, Mauritius, Denmark, Bulgaria, Cyprus, Croatia, Latvia, Romania, and Hungary, experiencing decreasing returns to scale (DRS) were higher than those in U.S.E schools in western Uganda. It should be known that inputs into U.S.E schools in western Uganda, in terms of mean enrolment, number of class rooms, school land size and school annual budgets are way lower than inputs in any western world schools (European Union, 2020; MacGregor, 2022), given the global economic divide, and as such, it was easier for many U.S.E schools in western Uganda to strike an input-output balance or have higher output than schools in the global north. That explains the lower T.E among schools in Europe, however, the lower technical efficiency of schools in Europe does not necessary imply that secondary schools in Europe have a lower quality of secondary school education than those in western Uganda.

Secondary schools in Europe and the global north at large are ranked as being of high quality, the low technical efficiency notwithstanding, and that is because of the buffer effect of the immense amount of resources input into the schools in those regions. The low technical efficiency therein simply means that secondary schools in the global north face a lot of resource wastage, per output, even though the outputs are excellent, thanks to the buffer effect. The same is not true in the global south, where economic and resource constraints within secondary schools

are typical. In global south regions like Uganda, and western Uganda, to be specific, a buffer effect due to high input is unlikely, with the implication that any wastage in inputs is less likely to be offset by excellent outputs. In other words, the DRS that can be experienced by schools in the global south, due to technical inefficiency can be comparatively more severe than that in the global north, due to the meagerness of resources in the south. This explains why, despite the low technical efficiency in secondary schools within the global north, the general quality of secondary school education in that global region remains regarded as being of higher quality than that in the south (Mbandlwa, 2020; World Population Review, 2021; Kaur, 2023).

Therefore, for countries in the global south, maintenance of high technical efficiency is the only way through which secondary education quality will have to be achieved, given the resource constraints. With that postulation, it can be said that the level of T.E among U.S.E schools in western Uganda is to a certain extent, laudable, especially given that the U.S.E schools operate with inputs that cannot, in any way, be considered sufficient or to be the highest in quality, especially in developing country like Uganda. By having nearly two thirds of the U.S.E schools efficient, with a mean VRS efficiency of 0.96 and a mean CRS efficiency of 0.85 (Table 9 and Table 10), there is good progress in being technically efficient. That is because of the implication that the schools would still operate efficiently with about 10% less resources than they currently operate with. In other settings (e.g. Sotiriadis et al., 2018; Provazníková and Chlebounová, 2018; Chlebounová, 2019; Rohayana, 2018; Baba et al., 2021) secondary schools were reported to still be able to operate with more than 10% less resources than they were operating with,

which meant that there was a lot of resource wastage in those schools compared to the U.S.E schools in western Uganda.

Nevertheless, there is need for the U.S.E schools in the western region to significantly augment their technical efficiency, if the education goals of the country are to be met. Having more than 3 in every 10 U.S.E schools technically inefficient, going by the VRS approach means that between 3 and 4 of the U.S.E schools in western region are experiencing a lot of resource wastage (DRS). That is quite substantively high, especially in a resource constrained and indebted country like Uganda, given that the resources wasted in that proportion of schools translates into 56 U.S.E schools in the region and about 15,000 secondary school students missing out on being high performers. According to the systems theory (von Bertalanffy, 1968), the imbalance (equal, positive or negative) between inputs and outputs is influenced by factors within the environment of the system. In education system, two of the most important factors including the headteacher and larger environment of the school, and the effect of both of them was analyzed.

5.2 The intrapersonal factors influencing the level of technical efficiency in public universal secondary schools within western Uganda

The systems theory suggests that staff within the environment in which a given system operates determine the efficiency of a system. In the context of an education system, the main players in the management of technical efficiency (input and output balance) are headteachers, given that they are the ultimate financial, administrative and public administrators in any given school (Danburam, 2022; Leksy et al., 2023; Simovska et al., 2016; Darlington et al.,

2018; Verger et al., 2019; Constantia et al., 2021; Moore et al., 2024). The findings of this study are highly congruent with the suppositions of the systems theory, given that up to seven intrapersonal characteristics of the respective headteachers were found to have statistically significant influences on the technical efficiency of the schools. The same has been found to be true in previous studies, in which leader intrapersonal characteristics were found to predict general institutional performance and efficiency (Nyakundi and Munyao, 2022; Flanigan et al., 2017; Fujianti, 2018; Al Khajeh, 2018; Akparep et al., 2019; Cakir and Adiguzel, 2020; Hamdal et al., 2019; Campos-García and Zúñiga-Vicente, 2019; Hendrawijaya, 2019; Met and Ali, 2014; Alshumrani et al., 2022; Rao and Zaidi, 2019; Nugroho et al., 2023; Oyeniran and Akphorhonor, 2019).

One of the intrapersonal characteristics that were found to be significantly related to technical efficiency was the duration of occupancy in the headteachers office of a given secondary school. The study found that the prevalence of technical efficiency was less by 27% at schools whose headteachers had been in occupancy of their respective office for < 5 years compared to those who had been headteacher for more than 6 years. This finding speaks to work experience in the office of the headteacher, at a particular school, and is as such consistent with findings by Met and Ali (2014) and Oyeniran and Akphorhonor (2019), Omori and Bassey (2019), and Nugroho et al. (2023). Evidence from the qualitative findings also concurred with the quantitative findings. It was mentioned by almost all the headteachers and all the key informant as being one of the most important factors that are influencing technical efficiency at U.S.E schools in western Uganda. Headteacher's experience was so important that to some qualitative study participants, it was the most important factor that mattered. Work experience is outrightly linked to the number

of years worked, given that it comes with an increase in knowledge, skill, and higher familiarity with one's work, especially if they are directly involved in its execution. However, work experience has categories to it, there is work experience related to how long one has done a particular activity, and then there is work experience related to how long one has occupied a particular office.

In the context of U.S.E schools in western Uganda, it is the latter category of work experience that was found to be important, but still with less experience in the headteachers office being related to lower technical efficiency of the school. This was expected, because being new in the headteachers' office of a given U.S.E school comes with a myriad of challenges, including adjustment to a new environment, establishment of rapport with both teachers and students, familiarization with the school environment, familiarization with the system left by one's predecessor, and familiarization with available infrastructure of the school. At times, depending on the culture of the school in which the new headteacher has been deployed, it can take some time, and a number of in-school battles to fit into the new school. This means that it is not typical for a headteacher deployed into a new school, to immediately make new financial policies, manage all school inputs and also ensure high outputs, within two or three years. Usually, it is after five years that the new headteacher gets significantly familiar with every small detail of the school which is administratively inherited, to the extent that they get to firmly implement their own resource and financial management systems, that can guarantee high technical efficiency.

The prevalence of technical efficiency was less in U.S.E schools whose headteachers sometimes / rarely applied conceptual skill of setting Goals,

Objectives or targets for the school, compared to those who never did so. This finding has a lot to do with the effect of an individual headteachers personality on performance. One of the personality traits of a leader, that have been found to be significantly related to staff performance is conscientiousness (Rababah, 2019; Kang and Malvaso, 2023;Törnroos et al., 2019 Judge and Zapata, 2015). That personality deals with being organized and responsible as a leader to the extent that goal setting for all staff is made (Kang and Malvaso, 2023). That personality, in a leader, cultivates a culture of direction among staff, a higher sense of belonging to the organization and higher motivation, which ultimately contributes to organizational growth and technical efficiency. Therefore, a leadership personality of seldomly setting goals is antagonistic to all the aforementioned organizational outcomes, which explains why technical efficiency was less at U.S.E schools whose headteachers sometimes / rarely applied conceptual skill of setting Goals, Objectives or targets for the school.

Besides the effects of personality, the finding is also related to the managerial practice of goal setting, which has been found to be independently associated with organizational performance and technical efficiency. Therefore, the finding is consistent with findings from numerous studies (Pervaiz et al., 2021; Neumann& Hohnke, 2018). Aguilera et al., 2024; Chua et al., 2018; Gary et al., 2017; Hu and Bettis, 2018; Kotlar et al., 2018; Mazmanian, and Beckman, 2018; Gary et al., 2017; Hahn, Minola, and Eddleston, 2019; Opper et al., 2017; Baker et al., 2019; Elia et al., 2023; Yang et al., 2023), in which goal setting has been found to influence organizational performance. Goal setting, according to the goal setting theory, has been known to increase performance (Rainey & Jung, 2015), through setting a course of action that each staff should take, promoting self-efficacy, and

making each staff to know what they are expected of, and personally determining what they should do in order to contribute to the overall goal of an organization (Groeneveld and Kuipers, 2018). Thus, goal setting is most likely to increase staff motivation, and accountability on the part of each staff who subscribes to the organization that set a given goal. Such intrinsic and extrinsic cultures set in an objective-based organization make every staff member to become focused on effectively utilizing all resources that the organization has, and in a school setting, ensuring that all students excel in their national assessments. With goals always set by a given headteacher therefore, technical efficiency of a given secondary school with such a headteacher is almost always guaranteed. However, when not routinely done, as per managerial standards and policy, then motivation, self-efficacy, self-drive, accountability and high organizational engagement become compromised. That also explains why technical efficiency was lower at U.S.E schools in which headteachers sometimes / rarely applied the conceptual skill of setting Goals, Objectives or targets for their school. Teachers therein simply had no reason to be effective at work, be accountable for anything, or have self-drive.

However, technical efficiency was twice as high at U.S.E schools whose head teachers who sometimes / rarely applied human relations skills of delegating staff with different management tasks in the school compared to those who never did so. Reference to findings in table 11a indicate that only one attribute (sometimes/rarely) within the delegation variable was significant, which implies that simply delegating tasks to staff, even infrequently, can significantly increase technical efficiency. This finding is consistent with findings by Nwokocha & Iheriohanma (2015), Sloof and von Siemens (2021), Zhang et al. (2017), Lluís et al. (2022), Huo and Boxall (2018), Neirrotti (2020), Sloof and Von Siemens (2021), and

Ye et al., 2022), which delegation was found to have the same influence. Evidence has it that when staff are requested to take up management tasks or activities that they wouldn't have personally accorded to them, but always wished they would have, they get highly motivated (Sloof and Von Siemens, 2021; Manzoor et al., 2021; Karaferis et al., 2022). With the known effects of high staff motivation on performance (Diem et al., 2022; Olafsen et al., 2018; Deressa and Zeru, 2019), it comes to no surprise that with delegation came high technical efficiency at U.S.E schools where the headteachers at times delegated duties to their staff. Further still, with delegation, especially to carry out managerial tasks, lowers power distance, that is, reduces the belief that there is unequal distribution of power and authority in an organization (Hofstede et al., 2003). Such reduction in power distance cultivates a sense of belonging, being part of the organization, and makes the delegate to further appreciate the objectives of the organization, and feel obliged to collectively have them achieved. As noted earlier, that also increases the performance of the delegate, who can then assume their managerial role to delegate and influence other staff to also work towards achieving organizational objectives, which collectively increase technical efficiency.

What was however found to be surprising was the finding that the prevalence of technical efficiency was less by 64% at U.S.E schools whose head teachers always applied human relations skills of holding informal conversations with teaching staff compared to those who never applied human relations skills of holding informal conversations with teaching staff. Holding conversations with staff is a leadership trait akin to democratic and transformational leadership, both of which have been reported to having a positive impact on staff performance (Akpaprep et al., 2019; Cakir and Adiguzel, 2020; Hamdal et al., 2019; Cakir & Adiguzel, 2020; Sloof and

von Siemens, 2021; Sarwar et al., 2022). However, in the context of headteachers of U.S.E schools in western Uganda, some headteachers, who headed schools that were not so efficient were those who held informal conversations with their teaching staff. Unlike formal conversations between leaders and their subordinates, informal ones can at times result into high habituation with the leadership and at times, reduction in respect of leaders and increased non-compliance with guidelines. This does not entirely imply that informal conversations between leaders and their staff are entirely derogatory, but that if done frequently, it may turn out to be disadvantageous, with the above mentioned outcomes. When incident, staff may friendzone their headteachers, lose focus of the goals that were set by the headteacher, which in the medium and long term can perpetuate presenteeism, or even absenteeism, on the supposed premise that they (Teachers) will be able to hold informal conversations with their leaders and go unpunished. If persistent, such practices, that erupt from frequent informal conversations with leaders can ultimately hence lower efficiency of the schools implicated.

What was also surprising was the finding that technical efficiency was less by 65% at U.S.E schools whose headteachers applied technical skills, to set guidelines to monitor students' termly performance compared to those never applied technical skills, to set guidelines to monitor students' termly performance. Ideally, one would have expected that setting guidelines to monitor termly performance would increase odds of technical efficiency, as goal setting does (Patton, 2018; Bamberger, Rugh, & Mabry, 2019; Allin et al., 2017; WHO, 2015; Allin et al., 2017). Njiru and Thoronjo, 2023; Uwera and Wanjiku, 2023; Masawe and Isanzu, 2020). However, the difference between goal setting and setting guidelines to monitor

termly performance is that the latter is cash capital intensive, given that routine monitoring requires finances to be effectively implemented.

Thus, it can be postulated that the monitoring practices increase resource input, possibly leading to higher odds of DRS. It isn't that the finances put into monitoring are much; it is highly likely that there was a lot of resource wastage through inflation of activity costs, when it came to the implementation of monitoring activities, in some of the schools that were not efficient. The same was certainly true when it came to professional development workshops and the conduction of termly individual teachers' evaluation of performance. The findings showed that the prevalence of technical efficiency was less by 86% at U.S.E schools whose headteachers always applied technical skills, to carry out professional development workshops compared to those who never applied technical skills, to carry out professional development workshops. It was also found that the prevalence of technical efficiency was less by 75% at U.S.E schools whose head teachers always applied technical skills, to conduct individual teachers' evaluation of termly performance. Ideally, professional development and staff appraisal should be protagonists of staff performance (Zhang et al., 2022; Parker et al., 2019; Siraj and Hågen, 2023), however, in the context of technical efficiency, high input into the two otherwise effective human resource development activities can offset their effectiveness. That is to the extent that their inflated cost of implementation on a routine basis can increase risk for DRS.

5.3 The institutional factors influencing the level of technical efficiency in public universal secondary schools within western Uganda

According to the systems theory, the balance between inputs and outputs is significantly influenced by the environment around the system, which in the context of a secondary school represents the school as a whole institution. The findings of this study, obtained from the assessment of institutional factors influencing the level of technical efficiency in public universal secondary schools within western Uganda, concur with the suppositions of the systems theory. At least two institutional characteristics were identified as being significant factors influencing the technical efficiency of U.S.E schools in western Uganda. Therefore, generally speaking, the study findings are consistent with findings by a number of other studies (Nabyonga-Orem et al., 2023; Baba et al., 2021; Ali et al., 2017; Yitbarek et al., 2019; See and Yen, 2018; Gong et al., 2019; Njiru and Thoronjo, 2023; Jordi et al., 2020; See and Yen, 2018; Ibrahim et al., 2019) that have found associations between institutional characteristics and technical efficiency. One of the two institutional characteristics that were found to be significant was the annual budget of a given U.S.E school. The findings show that the prevalence of technical efficiency was less by 79% in U.S.E schools whose annual budget ranged from 201 to 350 million compared to those whose annual budget ranged between 351 and 500 million. This finding implies that U.S.E schools with smaller annual budgets were less efficient than schools with larger budgets. In other words, schools with smaller budgets had smaller outputs than their budgetary inputs, and hence experience more DRS returns on investment than schools with bigger annual budgets.

The finding of the study concurs with findings from previous studies by Cao et al. (2022), Popescu et al. (2014), See and Yen (2018), Gong et al. (2019), Moses et al. (2021), Cha et al. (2018), Zeng et al. (2022). Ibrahim et al. (2019), Karpa et al. (2014), Allin et al. (2016) and Zeng et al. (2022), all of which reported that there was a direct proportional relationship between annual expenditure and technical efficiency. This finding was expected, given that with a higher budget, especially in a low resource setting like Uganda, there are more resources that get at the disposal of any administrative system. In a secondary school setting, it implies that there will be higher chances of having teachers remunerated with fringe benefits, more teaching resources deployed, and generally having more motivated staff. All that ultimately leads to better staff (teacher) performance and hence more output in terms of student performance, which ensures technical efficiency (Diem et al., 2022; Olafsen et al., 2018; Deressa and Zeru, 2019). However, having an annual budget in the range of 200 and 300 million is not insignificant, that is a substantial amount of expenditure for a school in a low resource setting or a U.S.E school to be particular. Therefore, there were certainly contextual factors and characteristics that increased the odds of technical inefficiency at schools which had budgets of less than 300 million. Cross tabulation analyses between some key intrapersonal, institutional variables and the annual budget were done (Appendix G), and they indeed proved that schools with smaller budgets had characteristics that increased their odds of inefficiency.

For instance, it was found that most of the head teachers that had spent less than five years in office were at schools which had smaller budgets (Table 13). This finding implies that smaller budget schools were most likely fond of having headteachers with little experience in the financial, administrative and human

resource going on in those schools. As earlier mentioned, such headteachers usually require some significant periods of time to acquaint themselves with the new school system they are in, before they can make significant changes therein, and lead the school towards efficiency.

Besides, one of the challenges that lowly funded secondary schools face is the capacity to implement and monitor certain activities that are resource intensive, one of which is goal setting. The additional cross tabulations showed that head teachers at schools with less than 300 million as their annual budget were more likely to never set goals, compared to those heading schools that had budgets exceeding 300million. Still as earlier emphasized, having no goals set reduces morale, self-efficacy, accountability, engagement, and motivation among staff, which reduces their performance, with the ultimate outcome being reduced output and hence inefficiency.

It was also noted that at schools with budgets less than 300 million, that there was more frequent implementation of professional development workshops and teacher performance evaluation (Table 13), compared to schools with bigger budgets. This implies that there was more wastage of funds on activities whose expenditure may have been inflated, as earlier evidenced, on issues that may have not directly impacted on the outputs (U.C.E performance).

The second institutional characteristic that proved to be significant was the energy source used at a given school. The findings showed that the prevalence of technical efficiency was twice as high at U.S.E schools which used electricity / generator as their energy source compared to schools which used solar energy. This finding implies that solar energy use was associated with lower technical

efficiency. It is a known fact that solar energy use reduces expenditure on energy (Owusu-Sekyere et al., 2024; Altassan, 2023; Wagner et al., 2021), to the extent that it can reduce budgetary expenditure by a certain margin. The cost of solar energy resource and installation have also significantly reduced, by up to 70% (Ritchie, 2024), and thus, it would be expected that a school with sole reliance on solar energy would save some amount of money on monthly energy expenditure. A typical school requires a 30KW solar system, on average, which can result into savings of up to \$650 on electricity per month (EcoFlow, 2023). That can translate into savings of up to approximately 30 million, annually, which is quite significant.

However, as can be seen from the findings, reliance on solar systems for energy was associated with lower technical efficiency, that is, lower outputs at each school with the solar system, than inputs. That happened because of a number of reasons, one of the most plausible ones potentially being that the head teachers with solar powered schools may have ploughed back the savings made on electricity, and invested them in school activities that do not directly translate into better student performance. A case in point could be professional development activities, which as earlier elucidated, are being possibly implemented with exorbitant costs that increase risk of DRS, and hence reduced technical efficiency. On the other hand, solar power, despite being cost effective, comes with some demerits, one of which is that solar power may not be available at all times, since it depends on sunlight. In rainy or cloudy conditions, the solar batteries do not charge adequately, which results into solar power being unavailable at times. In a school setting where solar is the sole source of energy, that can jeopardize school activities, and even affect the study practices of students, some of whom ought to engage in night reading or early morning

personal reading. Thus, solar power use can eventually affect student performance and hence school output, leading to DRS. That is unlikely when a school relies on hydroelectric power, which Uganda is currently producing in significant abundance, and is less likely to be switched off for more than an hour, currently. This explains why schools which relied on electric power were twice as technically efficient as those which were solar energy users. Therefore, it can even be postulated that in case a U.S.E school has both hydroelectric and solar power, it could be more than twice as likely to be technically efficient since a number of key output determining activities in a school depend on electricity

CHAPTER SIX:

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

The proportion of technically efficient schools in western Uganda is fairly high; about 7 in every 10 of the U.S.E schools in western Uganda are technically efficient, taking the perspective of inputs result into a change in out, either negatively or positively (VRS). In other words, about 7 in every 10 U.S.E schools produce more output than the inputs they receive annually (having an increasing return to scale [IRS]), and with a mean efficiency of 0.96, they can still operate at peak, with only 4% reduction in input. However, about 3 in every 10 U.S.E schools in the region produce less output than the inputs they receive annually (have a decreasing return to scale [DRS]). Technical efficiency of U.S.E schools in western Uganda gets worse when the CRS is considered; only 5 in every 10 of the U.S.E schools in the region can produce an equal amount of output, for every amount of input.

The technical efficiency of U.S.E schools in western Uganda is influenced by seven intrapersonal factors including the duration of occupancy of the headteachers in the office, rare application of the conceptual skill of setting goals, objectives or targets for the school, applied human relations skills of holding informal conversations with teaching staff, application of technical skills to set guidelines to monitor students' termly performance, application of technical skills to carry out professional development workshops, application of technical skills, to conduct individual termly teachers' evaluation of performance. Each of the aforementioned

intrapersonal characteristics of the headteacher had negative influence on the technical efficiency of U.S.E schools in western Uganda.

Two institutional factors influence the technical efficiency of schools in western Uganda, and those are the annual budget and energy source used, of which an annual budget ranging from 201 to 350 million decreased technical efficiency, while use of electricity as the energy source increased technical efficiency.

6.2 RECOMMENDATIONS

6.2.1 For practice and policy

From the findings obtained by this study, it is evidence that the augmentation of technical efficiency among U.S.E schools in western Uganda is actually possible, and can be done with very cost effective interventions, which largely require modification of some personal work / management / administrative practices on the part of the headteachers. One of the administrative practice modifications that will be required to be implemented by the headteachers will be the adoption of the practice of periodic goal, and/or objective setting, at least for every single academic year of the school they head. The headteachers simply have to convene staff meetings at the beginning of each academic year, lay out the school's goal and objectives for that given year, interest all the staff in the schools' goals, lay out strategies on how the school intends to achieve the goal, and have some of the staff participate in how else the goal could be achieved. Doing so will motivate the staff, increase their self-efficacy, feel more engaged at their work places, and increase their odds of being accountable at work, which will certainly increase

their performance, that will later on increase the output of each school, leading to IRS.

High power distance has been known to negatively impact on the performance of staff, however, while reduced power distance can augment staff performance, the reduced power distance should in most cases be preserved for formal conversations between headteachers and their staff. That is because informal conversations may cultivate a culture of familiarity and habituation between staff and headteachers, which may reduce charisma on the part of the headteacher, which may increase risk for workplace deviance among teachers, with the outcome being reduced performance.

The application of technical skills to set guidelines to monitor students' termly performance, application of technical skills to carry out professional development workshops, and application of technical skills to conduct individual teachers' evaluation of performance are all renowned managerial practices that can increase staff and organizational performance. However, in the application of the aforementioned administrative practices, headteachers are urged, for the benefit of their school's technical efficiency, to always ensure and consider cost-effectiveness in the application of all such practices. Monitoring and evaluation, and staff development are all costly interventions, however, they should not be exorbitantly done, and one of the ways that costs associated with their application can be reduced is by reducing the frequency of their implementation. The headteachers of U.S.E schools may consider having staff development workshops held not more than once a year, as opposed to termly basis, as some of them reportedly did. The ministry of education and sports may also consider enforcing a

policy similar to what the ministry of health recently enforced, of having workshops and staff development workshops held either within-facility or via the use of online platforms like zoom, as opposed to holding them in hotels or hired conference halls, which come at a cost. Taking such an approach will reduce costs associated with the aforementioned practices, and will hence reduce risk of DRS at each of the schools, as saved resources will get to be invested in other output augmenting practices.

On a positive note, the government of Uganda, through the ministry of Education and sports, is committed to gradually increasing the amount of capitation grant that it gives U.S.E schools, each year. This commitment should be adhered to, as it will consequently increase the number of resources and hence annual budgets for schools that are currently seemingly having small budgets. However, there is need for the ministry of education and sports of Uganda, to adopt the practice of assessing technical efficiency, especially of U.S.E schools that have annual expenditure that is less than 300 million, to determine which of them is having increasing returns to scale, so that such schools received more funding that can exceed 300 million, annually. Such schools will have been aided to be sustainably technically efficient. Schools with annual budgets that are less than 300 million, but with DRS should not have their budgets increased, until the negative factors influencing their technical efficiency are first solved.

Solar power use, is without a doubt, a cost-saver in terms of energy expenditure, and so, having sole reliance on solar power, associated with reduced technical efficiency implies that the savings made with solar use, may have been diverted into other non-productive activities that do not contribute to increasing school output. Therefore, first, headteachers are urged to utilize the savings made on

solar energy use, in activities that can directly impact on school output, for instance on increasing teacher fringe benefits. As a long term measure, the government of Uganda should also consider introducing the rural electrification program to areas where U.S.E schools are located, specifically those without electric power. Such a program will ensure that the schools are connected to hydroelectric power, that is more reliable, and as an emergency measure, solar power as well. With that, there will be high certainty that the schools will have a reliable power supply, that will not affect or interrupt student class attendance or their night preps.

6.2.2 For further study

According to the systems theory, the balance between inputs and outputs is significantly influenced by the environment in which the system operates. That environment is not only comprised of staff (e.g. headteachers), and institutions, but also the larger systemic characteristics comprised of national, local, or regional policies and legislation. Those are referred to as systemic characteristics, which this study did not delve into. Therefore, it would be prudent to have another study assess factors influencing the technical efficiency of U.S.E schools in any region of Uganda, whilst including systemic characteristics as one of the independent variables.

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APPENDICES

APPENDIX A: CONSENT FORM (QUESTIONNAIRE RESPONDENTS)

Title of the study: Technical efficiency and its influencing factors in public universal secondary schools in western Uganda

Principal investigator: Balinda Eskar Bangirana Richardson

Email: rhbalinda@yahoo.com

Introduction: Education is an undisputed promulgator of sustainable development and hence one without which all tenets of development cannot be achieved by any country. However, while all education levels are relevant for inculcation of knowledge, it has been evidently determined that the secondary school level is arguably the most important level of education. For that reason, many countries have gone to great lengths to ensure increased access to secondary school education, to extent of making it free for all. In the Ugandan context, the government introduced the universal secondary education model, in order to increase access to secondary-level education. The government provides capitation grants to each of the U.S.E schools, and has been gradually increasing the grants in order to increase funding to education. However, while it would have been expected that the increase in grants would reciprocate into an increase in output per U.S.E school, that has not been the explicit case, especially in western Uganda. Therefore, it could be that each of the U.S.E schools in the western region had gaps in technical efficiency, that make them not in position to translate inputs, including the capitation grant, into outputs, with no wastage.

Purpose of the study:To assess technical efficiency and its influencing factors in public universal secondary schools in western Uganda

Who is being targeted: This study is targeting head teachers or deputy head teachers of universal secondary education schools in the western region of Uganda. The particular category of head teachers targeted are those who have been in their respective administrative positions in those schools for at least three years.

Why you have been sampled: We have sampled you because you are one of the head teachers or deputy head teachers of universal secondary education schools in the western region of Uganda. Secondly, you have been a head teacher or deputy head teacher of the respective U.S.E school in your jurisdiction, for at least three years.

What your participation will involve:If you choose to be a participant in this study, you will be required to respond to some close-ended questions related to your socio demographic characteristics, intrapersonal characteristics, institutional characteristics and systemic characteristics. By being close-ended, we expect that the interview will require about 45 minutes of your time.

Risks: This study will be observational, and will thus involve no interventions or invasive procedures to be subjected to the respondents. Thus, the respondents in this study will be at absolutely no risk of being harmed as a result of this study.

Benefits of the study:There are numerous benefits that will arise from your participation in this study, for instance, with the data you will provide, we shall be able to compute the technical efficiency of this school, which will then enable us compute the technical efficiency of all U.S.E schools in the western region. With

that data, you will be able to know how efficient your school is in utilizing all inputs it uses, including the capitation grant, and hence be able to make necessary modifications, administratively, to augment efficiency, and hence make the school perform better. That will be enabled more by the fact that the data you will provided will also allow us to analyze the factors influencing technical efficiency, which you will be able to identify as well, and make evidence-based interventions tailored to improving technical efficiency.

The findings may also be of immense programmatic and perhaps policy significance given that the government of Uganda has been severally called upon to increase capitation grants more, for U.S.E schools, on the premise of the grants not being enough, for maximum output by the beneficiary schools. With the findings, the ministry of education and sports, will get to know whether the gaps in output by the U.S.E schools are purely to low capitation grants given to them, or due to technical efficiency gaps, on the part of the schools. In addition to establishing that fact, the ministry of will also be in position to evidently intervene in augmenting U.S.E school technical efficiencies, using evidence obtained by this study, on the institutional and systemic factors influencing technical efficiency, since it can ably intervene at those two levels of influence.

Confidentiality, privacy and anonymity: You can be assured that all the responses you will give will be kept confidential, and known to only the principal investigator as those that you personally gave. data collected was handled with utmost confidentiality; every single questionnaire was mobilized from the data collection assistants at the end of each data collection day, and kept with the principal investigator in a personal lockable cabinet. Even when it comes to data entry and

analysis, the two will be done on the principal investigators personal, password protected computer. We will make sure that no one else listens into the interview, apart from the moderator and the other group participants.

All Raw data will be guarded very much from any hackers to ensure that their high level of confidentiality. Proper encoding will be observed to avoid any identity of a headteacher of a school as the source of specific data. This data will be kept confidential because of the sensitivity of some of it, particularly that related to technical efficient inputs. Consequently, all data (including voice recordings) will be anonymized, to conceal the identities of not only the schools sampled, but also their head teachers. Even during transcription and thematizing of qualitative data, pseudonyms were used to annotate each response

Voluntary participation: Your participation in this study is voluntary; you are free to withdraw from this study at any time you want, without any consequences.

Inquiries: In case of any inquiry, please feel free to contact the principal investigator on Tel: 0782 270 133.

Consent

I have read the information above and have had an opportunity to ask questions about the [*research / activity*] and how my information will be used. I understand the purpose of the [*research /activity*] and what my child's participation involves.

I agree to take part in the study and for the information I will provide to be shared with my identity concealed.

I understand that anonymised [*information / research*] about me may be published within the [*project report / relevant document*], which may be published online and that published material from this [*project / report*] may be used and distributed for training and service design and development.

I know that my participation is voluntary and that I can choose to withdraw from the research at any point.

Respondent

Signed

Date

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Witness name:

Signed

Date

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APPENDIX B: QUESTIONNAIRE
PART A: SOCIODEMOGRAPHIC CHARACTERISTICS

Number	Question	Response options	Code of choice
1	Gender of head teacher	1. Male 2. Female	
2	What is your current age (Full years)	
3	What is your current level of qualification	1. Graduate 2. Post graduate	
4	Which of the following is the category of teaching subjects you specialized in	1. Arts 2. Sciences 3. Vocational subjects	
5	For how long have you been a secondary school teacher?	
6	For how long have you been a head teacher at this school?	

PART B: Technical efficiency assessment

PART B1: INPUTS

Number	Question	Response options	Code of choice
7	Student enrolment in 2017		
8	Student enrolment in 2018		
9	Student enrolment in 2019		
10	Number of class rooms in 2017		
11	Number of class rooms in 2018		
12	Number of class rooms in 2019		
13	School land size 2017		
14	School land size in 2018		
15	School land size in 2019		
16	Annual budget in 2017		
17	Annual budget in 2018		
18	Annual budget in 2019		
19	PTA To teachers in 2017		
20	PTA To teachers in 2018		
21	PTA To teachers in 2019		
22	PTA to students in 2017		
23	PTA to students in 2018		
24	PTA to students in 2019		
25	PLE quality intake in 2017		
26	PLE quality intake in 2018		
27	PLE quality intake in 2019		

PART B2: OUTPUTS

Number	Response options
UCE Performance in 2018	
UCE performance 2019	
UCE performance 2021	

PART C: INTRAPERSONAL CHARACTERISTICS

Number	Question	Response options	Code of choice
28	To what extent do you apply conceptual skill of assessing the school's Strength, Weaknesses, Opportunities, and threats annually.	1. Always 2. Sometimes / rarely 3. Never	
29	To what extent do you apply conceptual skill of setting Goals, Objectives or targets for the school Annually	1. Always 2. Sometimes / rarely 3. Never	
30	To what extent do you apply conceptual skill of scheduling activities in the school for the whole term/Year.	1. Always 2. Sometimes / rarely 3. Never	
31	To what extent do you apply	1. Always	

	conceptual skill of Reviewing the school management structure after every three years	2. Sometimes / rarely 3. Never	
32	To what extent do you apply conceptual skill of Networking with other schools to support each other	1. Always 2. Sometimes / rarely 3. Never	
33	To what extent do you apply conceptual skill of Aligning School plans with Vision, Mission, and Core values of the school	1. Always 2. Sometimes / rarely 3. Never	
34	To what extent do you apply Human relations skills of delegating staff with different management tasks in the school	1. Always 2. Sometimes / rarely 3. Never	
35	To what extent do you apply Human relations skills of Holding informal conversations with teaching staff	1. Always 2. Sometimes / rarely 3. Never	
36	To what extent do you apply Human relations skills of Holding	1. Always 2. Sometimes /	

	informal conversations with non-teaching staff	rarely 3. Never	
36	To what extent do you apply Human relations skills of Handling disputes among staff as soon as possible	1. Always 2. Sometimes / rarely 3. Never	
37	To what extent do you apply Human relations skills of Inviting Board of Governors (BOG) sometimes for interactive discussions about the school matters with school staff	1. Always 2. Sometimes / rarely 3. Never	
38	To what extent do you apply Human relations skills of Inviting Parents teachers Association Executive sometime times for interactive discussions about school matters with the staff	1. Always 2. Sometimes / rarely 3. Never	
39	To what extent do you apply Human relations skills of Participating in Social and Community Events	1. Always 2. Sometimes / rarely 3. Never	
40	To what extent do you apply technical skills, to weekly	1. Always 2. Sometimes /	

	supervise subordinates (support Supervision)	rarely 3. Never	
41	To what extent do you apply technical skills, to weekly walk around the school to see ongoing work activities and conditions of the facilities and taking requisite actions	1. Always 2. Sometimes / rarely 3. Never	
42	To what extent do you apply technical skills, to Operate using the school action plan that guides completion of school programmed	1. Always 2. Sometimes / rarely 3. Never	
43	To what extent do you apply technical skills, to Customize the national curriculum to fit the school departmental levels	1. Always 2. Sometimes / rarely 3. Never	
44	To what extent do you apply technical skills, to set guidelines to monitor students' termly performance	1. Always 2. Sometimes / rarely 3. Never	
45	To what extent do you apply	1. Always	

	technical skills; to Carry out staff skills needs assessment	2. Sometimes / rarely 3. Never	
46	To what extent do you apply technical skills, to carry out professional development workshops	1. Always 2. Sometimes / rarely 3. Never	
47	To what extent do you apply technical skills, to Conduct individual teachers' evaluation of performance termly	1. Always 2. Sometimes / rarely 3. Never	

PART D: INSTITUTIONAL CHARACTERISTICS

Number	Question	Response options	Code of choice
48	Mean enrolment of students (For the three years)	
49	School land size (for the three years)	
50	Mean annual budget of school (for the three years)	
51	Mean PTA To teachers	
52	Mean PTA to students	
53	Mean teacher enrolment	
54	PLE quality intake		
55	How would you rate adequacy of resources you have at your disposal, as a school	1. Adequate 2. Inadequate	
56	How would you rate the level of parental involvement in the affairs of this school	1. Adequate 2. Low 3. Very low	
57	How would you describe the location of the school	1. Rural 2. Urban 3. Peri-urban	

58	What is the main energy source of this school	<ol style="list-style-type: none"> 1. Electricity 2. Generator 3. Solar 	
59	Which of the following is the main water source of this school	<ol style="list-style-type: none"> 1. Rain 2. Borehole 3. Water Well 4. Water body (river, lake, stream) 5. Tap 	

END

APPENDIX C: CONSENT FORM (INDEPTH INTERVIEWEES)

Title of the study: Technical efficiency and its influencing factors in public universal secondary schools in western Uganda

Principal investigator: Balinda Eskar Bangirana Richardson

Email: rhbalinda@yahoo.com

Introduction: Education is an undisputed promulgator of sustainable development and hence one without which all tenets of development cannot be achieved by any country. However, while all education levels are relevant for inculcation of knowledge, it has been evidently determined that the secondary school level is arguably the most important level of education. For that reason, many countries have gone to great lengths to ensure increased access to secondary school education, to extent of making it free for all. In the Ugandan context, the government introduced the universal secondary education model, in order to increase access to secondary-level education. The government provides capitation grants to each of the U.S.E schools, and has been gradually increasing the grants in order to increase funding to education. However, while it would have been expected that the increase in grants would reciprocate into an increase in output per U.S.E school, that has not been the explicit case, especially in western Uganda. Therefore, it could be that each of the U.S.E schools in the western region had gaps in technical efficiency, that make them not in position to translate inputs, including the capitation grant, into outputs, with no wastage.

Purpose of the study: To assess technical efficiency and its influencing factors in public universal secondary schools in western Uganda

Who is being targeted: This study is targeting head teachers or deputy head teachers of universal secondary education schools in the western region of Uganda. The particular category of head teachers targeted are those who have been in their respective administrative positions in those schools for at least three years.

Why you have been sampled: We have sampled you because you are one of the head teachers or deputy head teachers of universal secondary education schools in the western region of Uganda. Secondly, you have been a head teacher or deputy head teacher of the respective U.S.E school in your jurisdiction, for at least three years.

What your participation will involve: If you choose to be a participant in this study, you will be required to respond to some open-ended questions related to your socio demographic characteristics, the technical efficiency of U.S.E schools in western Uganda, intrapersonal characteristics, institutional characteristics and systemic characteristics. We expect that the interview will require between 45 minutes and an hour minutes of your time.

Risks: This study will be observational, and will thus involve no interventions or invasive procedures to be subjected to the respondents. Thus, the respondents in this study will be at absolutely no risk of being harmed as a result of this study.

Benefits of the study: There are numerous benefits that will arise from your participation in this study, for instance, with the data you will provide, we shall be able to compute the technical efficiency of this school, which will then enable us compute the technical efficiency of all U.S.E schools in the western region. With that data, you will be able to know how efficient your school is in utilizing all inputs it uses, including the capitation grant, and hence be able to make necessary

modifications, administratively, to augment efficiency, and hence make the school perform better. That will be enabled more by the fact that the data you will provide will also allow us to analyze the factors influencing technical efficiency, which you will be able to identify as well, and make evidence-based interventions tailored to improving technical efficiency.

The findings may also be of immense programmatic and perhaps policy significance given that the government of Uganda has been severally called upon to increase capitation grants more, for U.S.E schools, on the premise of the grants not being enough, for maximum output by the beneficiary schools. With the findings, the ministry of education and sports, will get to know whether the gaps in output by the U.S.E schools are purely to low capitation grants given to them, or due to technical efficiency gaps, on the part of the schools. In addition to establishing that fact, the ministry of will also be in position to evidently intervene in augmenting U.S.E school technical efficiencies, using evidence obtained by this study, on the institutional and systemic factors influencing technical efficiency, since it can ably intervene at those two levels of influence.

Confidentiality, privacy and anonymity: You can be assured that all the responses you will give will be kept confidential, and known to only the principal investigator as those that you personally gave. data collected was handled with utmost confidentiality; every single questionnaire was mobilized from the data collection assistants at the end of each data collection day, and kept with the principal investigator in a personal lockable cabinet. Even when it comes to data entry and analysis, the two will be done on the principal investigators personal, password protected computer. We will make sure that no one else listens into the interview, apart from the moderator and the other group participants.

All Raw data will be guarded very much from any hackers to ensure that their high level of confidentiality. Proper encoding will be observed to avoid any identity of a headteacher of a school as the source of specific data. This data will be kept confidential because of the sensitivity of some of it, particularly that related to technical efficient inputs. Consequently, all data (including voice recordings) will be anonymized, to conceal the identities of not only the schools sampled, but also their head teachers. Even during transcription and thematizing of qualitative data, pseudonyms were used to annotate each response

Voluntary participation: Your participation in this study is voluntary; you are free to withdraw from this study at any time you want, without any consequences.

Inquiries: In case of any inquiry, please feel free to contact the principal investigator on Tel: 0782 270 133.

Consent

I have read the information above and have had an opportunity to ask questions about the [*research / activity*] and how my information will be used. I understand the purpose of the [*research /activity*] and what my child's participation involves.

I agree to take part in the study and for the information I will provide to be shared with my identity concealed.

I understand that anonymised [*information / research*] about me may be published within the [*project report / relevant document*], which may be

published online and that published material from this [*project / report*] may be used and distributed for training and service design and development.

I know that my participation is voluntary and that I can choose to withdraw from the research at any point.

Respondent: Signed: Date.....

Witness name:Signed: Date.....

APPENDIX D: INDEPTH INTERVIEW GUIDE

Sub-region in which head teachers school is located

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Sex of respondent

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What is your current age (full years)

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What is your marital status?

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What is your position in this school?

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For how long have you occupied that position?

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Probes

Kindly comment on the performance of this U.S.E schools specially in Uganda Certificate of Education exams, between 2020 and 2022? Elaborate with a trend description please

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Kindly comment on the inputs of this school, with specific focus on the quality of students enrolled into senior 1, quality of teachers, capitation grant, number of students enrolled in O-level, annual budget expenditure, between 2020 and 2022. Were the inputs sufficient enough, if yes, please elaborate, and If not, why not?

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I would like to pick your opinion on the technical efficiency of this school. How efficient is it, in terms of ensuring that whatever inputs they have translate into outputs (performance in U.C.E exams)? Do its outputs commensurate with their input, including the capitation grants they receive? Please elaborate

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Among the U.S.E schools in this district, how many of them do you think are 100% efficient, technically, out of every 10? Please explain

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From your experience as the headteacher in this school, what do you think are the

reasons behind the fact that this school is not 100% technically efficient (does not have their inputs universally translate into performance at U.C.E).

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Are their factors influencing the technical efficiency of this school, at an intrapersonal level (head teacher characteristics)? If yes which are those [Interviewer, probe for; age of head teacher, sex of head teachers, work experience of headteacher, teaching experience of head teacher, subjects taught

at school, education level of head teacher, experience in schools administration, type of leadership exhibited by head teacher]

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Are their factors influencing the technical efficiency of this school, at an institutional (internal characteristics of the schools themselves)? If yes, which are those [Interviewer, probe for; ownership status of the school, enrollment of the school, years of existence of the school, type of school, staff enrollment etc.]

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Are their factors influencing the technical efficiency of this school, at a systemic level (characteristics of the education sector of Uganda, and its administration)? [Interviewer, probe for; disbursement policies of capitation grants to the school, oversight practices of the DEO, oversight practices of the ministry of education, teacher enumeration delays, etc.]

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PPENDIX E: CONSENT FORM (KEY INFORMANT INTERVIEW GUIDE)

Title of the study: Technical efficiency and its influencing factors in public universal secondary schools in western Uganda

Principal investigator: Balinda Eskar Bangirana Richardson

Email: rhbalinda@yahoo.com

Introduction: Education is an undisputed promulgator of sustainable development and hence one without which all tenets of development cannot be achieved by any country. However, while all education levels are relevant for inculcation of knowledge, it has been evidently determined that the secondary school level is arguably the most important level of education. For that reason, many countries have gone to great lengths to ensure increased access to secondary school education, to extent of making it free for all. In the Ugandan context, the government introduced the universal secondary education model, in order to increase access to secondary-level education. The government provides capitation grants to each of the U.S.E schools, and has been gradually increasing the grants in order to increase funding to education. However, while it would have been expected that the increase in grants would reciprocate into an increase in output per U.S.E school, that has not been the explicit case, especially in western Uganda. Therefore, it could be that each of the U.S.E schools in the western region had gaps in technical efficiency, that make them not in position to translate inputs, including the capitation grant, into outputs, with no wastage.

Purpose of the study: To assess technical efficiency and its influencing factors in public universal secondary schools in western Uganda

Who is being targeted: This study is targeting head teachers or deputy head teachers of universal secondary education schools in the western region of Uganda. The particular category of head teachers targeted are those who have been in their respective administrative positions in those schools for at least three years. In addition to head teachers, this study is also targeting district education sector administrators in western Uganda. Those include district education officers, and school inspectors.

Why you have been sampled: We have sampled you because you are one of the district-level education sector administrators in western Uganda, that is either a district education officer or a school inspector. We are certain that by virtue of your position, you will be able to provide use with valuable information related to the technical efficiency of U.S.E schools in your jurisdiction and what factors you think influence their efficiency.

What your participation will involve: If you choose to be a participant in this study, you will be required to respond to some open-ended questions related to your socio demographic characteristics, the technical efficiency of U.S.E schools in western Uganda, intrapersonal characteristics, institutional characteristics and systemic characteristics. We expect that the interview will require between 45 minutes and an hour minutes of your time.

Risks: This study will be observational, and will thus involve no interventions or invasive procedures to be subjected to the respondents. Thus, the respondents in this study will be at absolutely no risk of being harmed as a result of this study.

Benefits of the study: There are numerous benefits that will arise from your participation in this study, for instance, with the data you will provide, we shall be

able to compute the technical efficiency of this school, which will then enable us compute the technical efficiency of all U.S.E schools in the western region. With that data, you will be able to know how efficient your school is in utilizing all inputs it uses, including the capitation grant, and hence be able to make necessary modifications, administratively, to augment efficiency, and hence make the school perform better. That will be enabled more by the fact that the data you will provide will also allow us to analyze the factors influencing technical efficiency, which you will be able to identify as well, and make evidence-based interventions tailored to improving technical efficiency.

The findings may also be of immense programmatic and perhaps policy significance given that the government of Uganda has been severally called upon to increase capitation grants more, for U.S.E schools, on the premise of the grants not being enough, for maximum output by the beneficiary schools. With the findings, the ministry of education and sports, will get to know whether the gaps in output by the U.S.E schools are purely to low capitation grants given to them, or due to technical efficiency gaps, on the part of the schools. In addition to establishing that fact, the ministry of will also be in position to evidently intervene in augmenting U.S.E school technical efficiencies, using evidence obtained by this study, on the institutional and systemic factors influencing technical efficiency, since it can ably intervene at those two levels of influence.

Confidentiality, privacy and anonymity: You can be assured that all the responses you will give will be kept confidential, and known to only the principal investigator as those that you personally gave. data collected was handled with utmost confidentiality; every single questionnaire was mobilized from the data collection assistants at the end of each data collection day, and kept with the principal

investigator in a personal lockable cabinet. Even when it comes to data entry and analysis, the two will be done on the principal investigators personal, password protected computer. We will make sure that no one else listens into the interview, apart from the moderator and the other group participants.

All Raw data will be guarded very much from any hackers to ensure that their high level of confidentiality. Proper encoding will be observed to avoid any identity of a headteacher of a school as the source of specific data. This data will be kept confidential because of the sensitivity of some of it, particularly that related to technical efficient inputs. Consequently, all data (including voice recordings) will be anonymized, to conceal the identities of not only the schools sampled, but also their head teachers. Even during transcription and thematizing of qualitative data, pseudonyms were used to annotate each response

Voluntary participation: Your participation in this study is voluntary; you are free to withdraw from this study at any time you want, without any consequences.

Inquiries: In case of any inquiry, please feel free to contact the principal investigator on Tel: 0782 270 133.

Consent

I have read the information above and have had an opportunity to ask questions about the [*research / activity*] and how my information will be used. I

understand the purpose of the [*research / activity*] and what my child's participation involves. I agree to take part in the study and for the information I will provide to be shared with my identity concealed.

I understand that anonymised [*information / research*] about me may be published within the [*project report / relevant document*], which may be published online and that published material from this [*project / report*] may be used and distributed for training and service design and development. I know that my participation is voluntary and that I can choose to withdraw from the research at any point.

Respondent: Signed: Date.....

Witness name: Signed: Date.....

APPENDIX F: KEY INFORMANT INTERVIEW GUIDE

Sub-region in which key informant operates

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Sex of respondent

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What is your current age (full years)

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What is your marital status?

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What is your position in the education sector of this district?

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For how long have you occupied that position?

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Probes

Kindly comment on the performance of U.S.E schools in Western Uganda, and in this district, specially in Uganda Certificate of Education exams, between 2020 and 2022? Elaborate with a trend description please

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Kindly comment on the inputs of U.S.E schools in Western Uganda, and in this district, with specific focus on the quality of students enrolled into senior 1, quality of teachers, capitation grant, number of students enrolled in O-level, annual budget expenditure, between 2020 and 2022. Were the inputs sufficient enough, if yes, please elaborate, and If not, why not?

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I would like to pick your opinion on the technical efficiency of Universal secondary Education schools in this district. How efficient are they, in terms of ensuring that that whatever inputs they have translate into outputs (performance in U.C.E exams)?. Do their outputs commensurate with their input, including the capitation grants they receive? Please elaborate

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From your experience as a district education officer or inspector of schools in this district, what do you think are the reasons behind the fact that some U.S.E schools in this district are not technically efficient (do not have their inputs universally translate into performance at U.C.E).

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Are their factors influencing the technical efficiency of U.S.E schools in this district, at an intrapersonal level (head teacher characteristics)? If yes which are those [Interviewer, probe for; age of head teacher, sex of head teachers, work experience of headteacher, teaching experience of head teacher, subjects taught at school, education level of head teacher, experience in schools administration,

type of leadership exhibited by head teacher]

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Are their factors influencing the technical efficiency of U.S.E schools in this district, at an institutional (internal characteristics of the schools themselves)? If yes, which are those [Interviewer, probe for; ownership status of the school, enrollment of the school, years of existence of the school, type of school, staff enrollment etc.]

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Are their factors influencing the technical efficiency of U.S.E schools in this district, at a systemic level (Interviewer, probe for; characteristics of the education sector of Uganda, and its administration, disbursement policies of capitation grants to the school, oversight practices of the DEO, oversight practices of the ministry of education, teacher enumeration delays, etc.)

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APPENDIX G: ADDITIONAL CROSS TABULATIONS

Variable	Annual budget					
			< 50 million	51 - 200million	201 - 350 million	351 - 500 million
Applys conceptual skill of setting Goals, Objectives or targets for the school Annually						
Always	80	50.0	2 (2.5%)	10(12.5%)	35 (43.8%)	33 (41.3%)
Sometimes / rarely	16	10.0	0 (0.0%)	1(6.3%)	7 (43.8%)	8 (50.0%)
Never	64	40.0	4(6.3%)	8(12.5%)	28(43.8%)	24(37.5%)
Applys conceptual skill of scheduling activities in the school for the whole term/Year.						
Always	109	68.1	3(2.8%)	11(10.1%)	46(42.2%)	49(45.0%)
Sometimes / rarely	10	6.3	0(0.0%)	2(20.0%)	7(70.0%)	1 (10.0%)
Never	41	25.6	3(7.3%)	6(14.6%)	17(41.5%)	15 (36.6%)
Applys Technical skills, to carry out professional development workshops						
Always	16	10.0	0(0.0%)	3(18.8%)	9(56.3%)	4(25.0%)
Sometimes / rarely	85	53.1	2(2.4%)	8(9.4%)	45(52.9%)	30(35.3%)
Never	59	36.9	4(6.8%)	8(13.6%)	16(27.1%)	31(52.5%)
Applys Technical skills, to Conduct individual teachers evaluation of performance termly						
Always	17	10.6	0(0.0%)	2(11.8%)	6(35.3%)	9(52.9%)
Sometimes / rarely	95	59.4	4(4.2%)	9(9.5%)	44(46.3%)	38(40.0%)
Never	48	30.0	2(4.2%)	8(16.7%)	20(41.7%)	18(37.5%)

APPENDIX H: APPROVAL LETTER (REC)



**UGANDA CHRISTIAN
UNIVERSITY**

A Centre of Excellence in the Heart of Africa

24th March, 2021

TO WHOM IT MIGHT CONCERN

Dear Sir/Madam,

RE: INTRODUCTORY LETTER FOR BALINDA ESKAR BAINGANA RICHARDSON

Warm greetings from Uganda Christian University!

This serves to introduce the above named; Balinda Eskar Baingana Richardson, as our student pursuing a Doctoral degree (PhD) in Education and Management registration number RM17P02/010.

Richard is conducting a research as a requirement for the award of the above mentioned degree entitled; *Measuring and determining the factors affecting technical efficiency in Universal Secondary Education Funded (USEF) schools in Uganda. A case of Western region.*

He has obtained approval from Uganda Christian University Research Ethics Committee (UCUREC) which is accredited and regulated by Uganda National Council for Science and Technology (UNCST). As a doctoral student, he now requires final research registration from UNCST to be permitted to collect data.

This is therefore to request for an administrative clearance from the Ministry of Education and Sports permitting him to access the study sites.

Any assistance given to him will be highly welcome.

Thank you so much.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Peter Ubomba-Jaswa'.

Prof. Peter Ubomba-Jaswa
Head, Research, Grants & Publications,
School of Research & Post-Graduate Studies,
Uganda Christian University.
pubombajaswa.ucu.ac.ug



A Complete Education for A Complete Person

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Founded by the Province of the Church of Uganda, Chartered by the Government of Uganda

APPENDIX I: LETTER (UNCST)


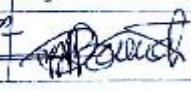

1000 0000 0000

Funds Transfer Form

Date 17/5/2021

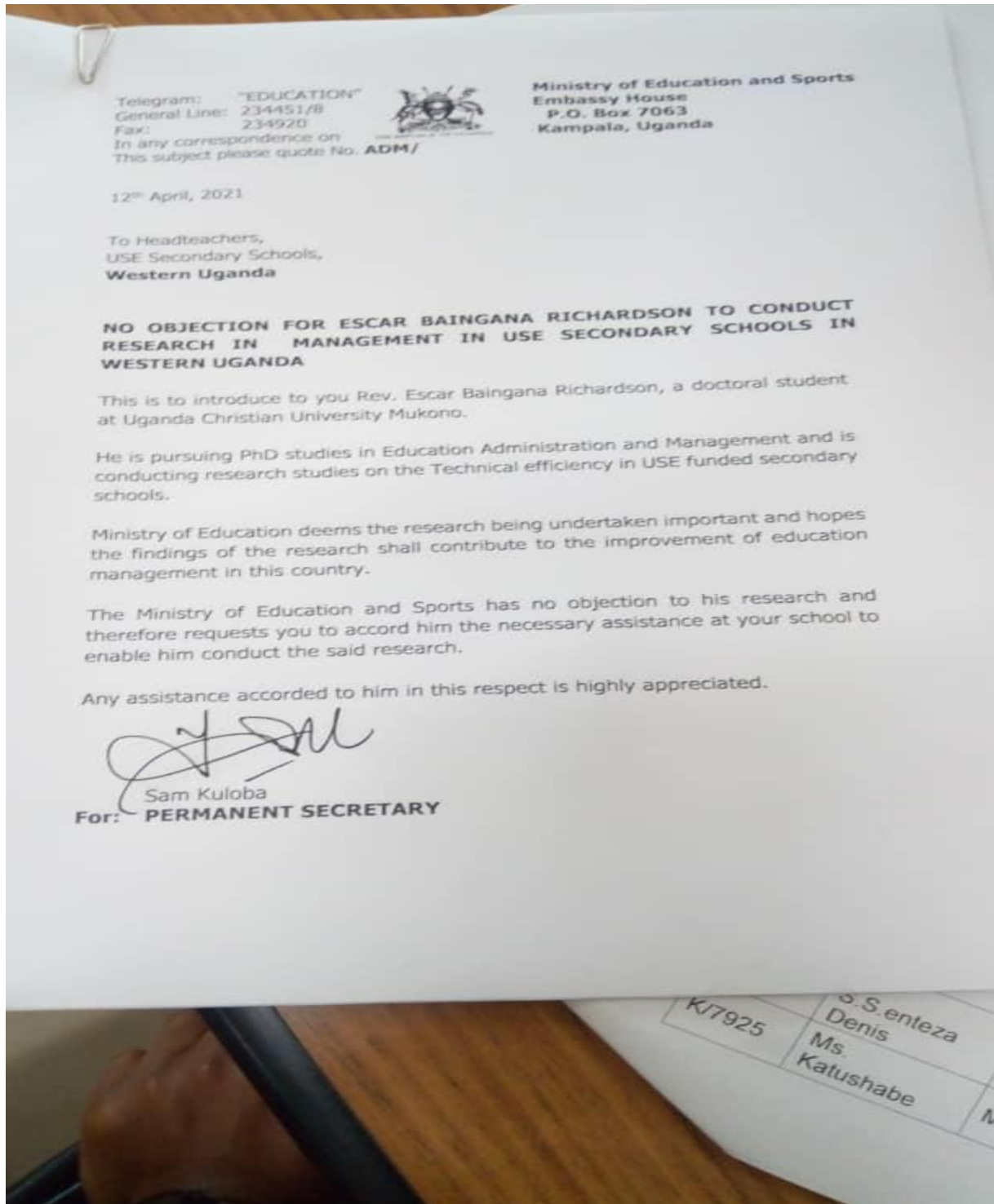
Select the Type of Payment Transfer
 RTGS AFT IAT

Branch Name FORT PORTAL

Debit Customer Details			
Account Number	<u>021077401501</u>		
Account Name	<u>BALINDA ESKAR BAWGANA RICHARDSON</u>		
Physical Address			
Telephone Number	<u>0782 2701 33</u>		
Customer ID Type	ID Number		
Debit Currency	<u>UGX</u>	Transfer Currency	<u>UGX</u> Rate
Amount in Figures	<u>181500</u>		
Amount in Words	<u>One hundred eighty one thousand five hundred and fifty only</u>		
Source of Funds			
Beneficiary Details			
Account Number	<u>0105610632101</u>		
Account Name	<u>Uganda National Council for Science & Technol</u>		
Bank Name	<u>Standard Chartered Bank</u>		
Purpose of Funds	<u>Research</u>		
Charges Borne By	<input checked="" type="checkbox"/> Payer <input type="checkbox"/> Beneficiary <input type="checkbox"/> Both <input type="checkbox"/> Not Applicable		
Customer's undertaking			
<p><i>I/We irrevocably agree to indemnify the Bank against any liability, loss, or claims in connection with this fund transfer request.</i> <i>I/We further understand and accept that RTGS instructions from customers for same-day value must be presented to the Bank before 15:15hrs E.A.T and instructions presented thereafter will be dealt with on a best endeavor basis.</i></p>			
Customer's Signature/s	Signatory 1	Signatory 2	Signatory 3
			
Form Delivered By	Full Name	Signature	Date & Time
	<u>BALINDA ESKAR BAWGANA RICHARDSON</u>		<u>17/5/2021, 4:30pm</u>
For Official Use			
Received By: (Name, Signature and Branch Stamp)	Authorized Signatory 1	Authorized Signatory 2	
			

Stanbic Bank IT CAN BE

APPENDIX J: LETTER (MINISTRY OF EDUCATION AND SPORTS)



APPENDIX K: ORIGINALITY REPORT

Richardson Balinda

TECHNICAL EFFICIENCY AND ITS INFLUENCE IN PUBLIC UNIVERSAL SECONDARY SCHOOLS

- Quick Submit
- Quick Submit
- Uganda Christian University

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