IDIA2018
Making ICT Research Locally Relevant

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Proceedings of the 10th Conference of the International Development Informatics Association (IDIA 2018)

August 23 – 24, 2018

Hennopsriver Valley

Tshwane

South Africa

Copyright Notice

Message from the Conference Chair

Welcome to the 10th International Development Informatics Association Conference (IDIA 2018). I trust that you will experience an informative and inspiring conference at La Wiida Lodge in the beautiful Hennopsriver Valley of the Gauteng province in South Africa.

The goal of IDIA conferences is to provide delegates with an opportunity to share ideas, focusing on research on the use of ICT for developing economies and societies (ICT4D), where various constraints impact on the use of ICT compared to highly developed regions. IDIA aims to balance the need for a high level of academic input from all involved with the need to develop emerging researchers. This 10th IDIA conference offers the opportunity to look back, take stock and debate the way ahead. The accepted papers reflect the local and international discourses in ICT4D, in keeping with the IDIA 2018 theme, *Making ICT Research Locally Relevant.*

We are fortunate to have an international keynote speaker from, Judge Business School, University of Cambridge, Prof Geoff Walsham. In addition, we co-hosted an IFIP 9.4 Masters and Doctoral Symposium for Sub-Saharan Africa (Southern and Eastern). This was chaired by Prof Caroline Khene and Ms Gugu Baduza with Prof Walsham and Prof Robert Davison, IFIP 9.4 Chairperson from the City University of Hong Kong as invited speakers.

On behalf of the IDIA community, I wish to express our deepest appreciation to our sponsor, the College of Science, Engineering and Technology at the University of South Africa.

A successful conference requires the effort of many individuals. We would like to thank the members of the program committee for their hard work. We are grateful to the authors who submitted their papers to this conference and the reviewers for sharing their expertise so mindfully. I also wish to extend my sincere thanks to all members of the organising committee and congratulate them on a job well done.

We hope that the conference will provide the inspiration for new research ideas and the opportunity for making fruitful connections whilst enjoying the landscape and wildlife.

Judy van Biljon

IDIA 2018 Conference Chair

Message from the Proceedings Chairs

Being part of a revived IDIA conference, with the theme of *Making ICT Research Locally Relevant*, has been an exciting and inspiring opportunity for us.

This year, we explored new frontiers. We successfully applied to Springer to publish selected papers as a Communication in Computer and Information Science (CCIS) volume. CCIS is abstracted/indexed in DBLP, Google Scholar, EI-Compendex, Mathematical Reviews, SCImago, and Scopus. CCIS volumes are also submitted for inclusion in ISI Proceedings. With this, IDIA 2018 has increased its international reach and standing.

The Springer requirements included establishing a Programme Committee that was internationally representative and sufficiently large to perform at least three reviews per paper. In line with Springer's quality guidelines, we also had to abide to an upper limit for the acceptance rate of papers included in the CCIS proceedings. The organizing committee carefully debated and considered the benefits and drawbacks of going the Springer CCIS route. The drawbacks included the transfer of copyright to a platform that was behind a paywall, and the potential sacrifice of author inclusivity. To mitigate the drawbacks we decided to adopt a dual system of issuing both a Springer Proceedings with more rigorous quality criteria, and in keeping with IDIA's developmental spirit, a more inclusive Conference Proceedings.

We received 61 papers for review. Each paper was reviewed by at least three reviewers in a rigorous double blind peer review process. Our international Programme Committee of 66 members contributed to improve the quality of the papers by giving comprehensive and constructive reviews. Authors had to submit corrected versions of the papers before final decisions were made about the papers' acceptance. The review process concluded with 20 papers accepted for the Springer CCIS Proceedings and an additional 14 papers for the Conference Proceedings; a total of 34 papers, an overall acceptance rate of 56% and an acceptance rate of 33% for the Springer volume.

This volume contains the 14 full papers as accepted for the Conference Proceedings, as well as the titles and abstracts of the papers that appear in the Springer volume.

Thank you again to all our reviewers and authors for making this conference a success, and a great thanks to Ms Cecile Koopman and her team who so diligently managed paper submissions and Springer template compliance checks.

Kirstin Krauss

Marita Turpin

Filistea Naudé

IDIA 2018 Proceedings Chairs

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10th IDIA Conference, Hennopsriver Valley, Tshwane, South Africa

23-24 August, 2018

Event Programme

Day 1: Thursday 23 August 2018		
08:30 – 09:30	Registration	
09:30 – 09:45	Opening: Prof B Mamba, Executive Dean: Unisa College of Science, Engineering and Technology (Venue: Africana)	
09:45 – 10:30	Keynote: Prof G Walsham (Venue: Africana)	
10:30 – 11:00	**Tea Break**	
	Sessions	
	Venue: Africana	**Venue: Marlotti**
	ICT adoption & Impact	**Mobile Education**
Session Chair	**Jean-Paul Van Belle**	**Jabulisiwe Mabila**
11:00- 11:30	An Investigation of the Government-related factors that inhibit SME's ICT adoption and effective use in Developing Countries: a Case of Zimbabwe (Peter Makiwa and Riana Steyn)	Youth unemployment in South Africa and the socio-economic capabilities from mobile phones (Hossana Twinomurinzi and Joshua Magunduni)
11:30- 12:00	It Should Be There, But It Is Hard to Find: Economic Impact of ICT in Sub-Saharan Economies (Sergey Samoilenko and Kweku-Muata Osei-Bryson)	Evaluation of the framework for sustainable mobile learning in resource-constrained environments in South Africa (Jabulisiwe Mabila and Marlien Herselman)

12:00 – 12:30	Domestication of ICTs in Community Savings and Credit Associations (Stokvels) in the Western Cape, South Africa (Nokwazi Biyela, Pitso Tsibolane and Jean-Paul Van Belle)	A socio-technical framework for mobile information system used to collect water quality information: A South African developing rural municipality case study (Henk Pretorius and Marie Hattingh)
12:30 – 13:00	Rethinking ICT4D Impact Assessments: Reflections from the Siyakhula Living Lab in South Africa (Hafeni Mthoko and Caroline Pade-Khene)	Smartphone Paradoxes in Working Mothers' Pursuit of Work-Life Balance (Karen Sowon, Olga Sikhwari, Mphatso Nyemba and Wallace Chigona)
13:00 – 14:00	**Lunch Break**	
	E-government	**E-Education**
Session chair	**Carl Jacobs**	**Tembisa Ngqondi**
14:00 – 14:30	Implementing E-government Financial Systems in a Developing Country: an Institutional Perspective (Hubeidatu Nuhu, John Effah and Jean-Paul Van Belle)	Development Outcomes of Training for Online Freelancing in the Philippines (Karsten Eskelund, Richard Heeks and Brian Nicholson)
14:30 – 15:00	Definitions of e-Government: Identifying the Blind Spots (Carl Jacobs and Ulrike Rivett)	A practical approach to integrated ITG practices at a South African university (Tembisa Ngqondi and Hope Mauwa)
15:00 – 15:30	Transitioning South Africa to a cashless economy as a developing country (Sidze Benjamin Mutheiwana and Roelien Brink)	A Qualitative Analysis of an E-education Initiative in deep rural schools in South Africa: A Need to Build Resilience (Sifiso Dlamini and Abraham van der Vyver)
15:30 – 16:00	**Tea Break**	
	Community development	**Design**
Session chair	**Emma Coleman**	**Adele Botha**
16:00 – 16:30	Global Standards and Local Development (Simon Pettersen Nguyen, Petter Nielsen and Johan Ivar Sæbø)	Building empathy for design thinking in e-Health : A Zimbabwean Case Study (Masiya Alex Marufu and Alta van der Merwe)
16:30 – 17:00	Enablers of Egalitarian Participation: Case Studies in Underserved Communities in South Africa. Processes of Creativity "Not for the Sake of it" (Maria Rosa Lorini, Wallace Chigona and Malcolm Garbutt)	Coming to terms with Telemetry: A scoping review (Martin Weiss, Adele Botha and Marlien Herselman)

17:00 – 17:30	Social Inclusion in the South African Information Systems Academic Community (Emma Coleman and Yao Ameyaw-Gyarko)	Towards a Provisional Workplace E-learning Acceptance Framework for Developing Countries (Gavin Armitage and Thomas van der Merwe)
17:30-18:00	The Role of Local Bricoleurs in Sustaining Changing ICT4D Solutions (Elisabeth Fruijtier and Wilfred Senyoni)	Localize-It: Co-Designing a Community-owned Platform (Maria Rosa Lorini, Melissa Densmore, David Johnson, Senka Hadzic, Hafeni Mthoko, Andre' Van Zyl, Ganief Manuel and Marius Waries)
19h00 – 22:00	**Gala dinner**	
	Day 2: 24 August 2018	
08:30 – 09:30	**Panel: 'Beyond access' (Venue: Africana)**	
9:30-10:00	**Future opportunities (Africana)**	
	Venue: Africana	**Venue: Merlotti**
	Sustainability & Resilience	**Community innovation & maturity**
Session chair	**Sifiso Dlamini**	**Dorothea Kleine**
10:00 – 10: 30	Revisiting Sustainability: Digital Libraries in Malawian Schools (Frederik Bachmann, Niels Kunz and Melih Kırlıdoğ)	The Role of the Marginalized and Unusual Suspects in the Production of Digital Innovations: Models of Innovation in an African Context (Paul Mungai, Andrea Jimenez, Dorothea Kleine and Jean-Paul Van Belle)
10:30 – 11:00	Scoping community resilience concepts relevant to a South African definition for resource constrained environments (Sifiso Dlamini, Marlien Herselman and Mario Marais)	Investigating Business Intelligence (BI) Maturity in an African Developing Country: A Mozambican Study (Sunet Eybers, Marie Hattingh and Osvaldo Zandamela)
11:00 – 11:30	Migrant workers use of ICTs in Unacceptable Forms of Work (Hannah Thinyane, Karthik Bhat, Don Junio, Jenny Ju and Catriona Craven-Matthews)	The Project Management Information System as Enabler for ICT4D Achievement at Capability Maturity Level 2 and Above (Mark Corrigan, John van der Poll and Emmanuel Mtsweni)

11:30 – 12:00	Tea Break	
	ICT adoption and impact	**Data**
Session chair	**Wallace Chigona**	**Sunet Eybers**
12:00 – 12:30	Supporting the Identification of Victims of Human Trafficking and Forced Labor in Thailand (Hannah Thinyane)	Identifying the constructs and agile capabilities of data governance and data management: A review of the literature (Tessa Lillie and Sunet Eybers)
12:30 – 13:00	Use of free public Wi-Fi at telecentres in disadvantaged communities in the Western Cape (Johan Du Bois, Wallace Chigona and Malcolm Garbutt)	How South Africa Can Harness the Data Revolution to Measure and Monitor Its Progress towards the SDGs (Jean-Paul Van Belle)
13:00 – 13:30	Rethinking Technology Enabled Development: A Critique of the Neo-Liberal Perspective Embedded in ICT4D Studies (Calisto Kondowe and Wallace Chigona)	Impact of teacher demographic factors on perceptions of ICT-enhanced teaching and learning in inclusive schools: Johannesburg Central District, South Africa (Charlotte Hlengwa, Bester Chimbo and Sheryl Buckley)
13:30 – 14:00	**CLOSURE: Africana**	
14:00	**Lunch Break**	

Please note: The remainder of this document is organised according to the themes and the papers as they appear in the various streams in the conference programme above. For papers included in the CCIS Springer volume, only abstracts are included and will begin on page 152.

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Appendix

Springer Accepted Publications (*Abstracts Only*)

ICT adoption & Impact

Session Chair:

Wallace Chigona

University of Cape Town, South Africa

Use of Free Public Wi-Fi and Telecentres in Disadvantaged Communities in the Western Cape

Johan Du Bois[1] [0000-0002-7097-6151], Wallace Chigona[2] [0000-0002-1059-811X] and Malcolm Garbutt ✉ [3] [0000-0002-0781-0415]

[1,2,3] University of Cape Town, Cape Town, South Africa
dbsjoh004@myuct.ac.za
wallace.chigona@uct.ac.za
malcolm.garbutt@alumni.uct.ac.za

Abstract. Telecentres have been the cornerstone of e-Government information and communications technology for development (ICT4D) programmes for addressing the digital divide and fostering economic development. A specific challenge for existing telecentre programmes is to establish what impact free public Wi-Fi (FPW) programmes have on the need for what the telecentres provide, what opportunities FPW provides to augment telecentres, and whether FPW at telecentres are a good use of public funds. To this end, this study explored the effect of FPW use on the behaviour of telecentre users through a survey undertaken at six government telecentres with nearby FPW facilities in the Western Cape, South Africa. The study shows that the activities undertaken by users at telecentres are similar to those using FPW. Although most smartphone users had used FPW at least once they were not frequent users of it. The most frequent use of FPW was observed to be for online banking and shopping than the telecentre computers. Further research is recommended to examine the finding of the limited use of FPW and to explore why telecentre users who are also FPW users prefer not to do online banking and shopping at the telecentre.

Keywords: ICT4D, Telecentres, Public Access Computers, Free Public Wi-Fi.

1 Introduction

The world is going digital. The digitally disadvantaged are at risk of being left further behind through lack of access to information and communication technology (ICT) and skills to use digital technology effectively [1], [2]. Recognising this danger, governments, multilateral institutions, and development agencies have sought to bridge this digital divide through public access computing (PAC) programmes aimed at providing computing devices, network connectivity, and training. However, these programmes, exemplified by free telecentres in disadvantaged and rural communities, have not been able to scale to the millions of access points required to bring billions of people online [3].

Where governments and development agencies failed, market forces released through telecommunications deregulation have partially succeeded [4] with mobile phones impacting lives world-wide even in communities previously excluded from ICT [5].

In South Africa, a high mobile phone penetration of 160 subscriptions per 100 people has been noted [6]. Of the 97% of South African households that have access to voice telephony at home 85% are mobile-only households. In addition, Internet access via mobile is around 50% of households [7]. Although mobile telephony and Internet access are widely available, the high cost of telecommunications services relative to incomes constrain their use. Poorer households have been observed to spend a substantial proportion of their income on airtime [8]. However, free public Wi-Fi (FPW) hotspots can provide these users with the means to use their devices for online tasks without the expense of mobile Internet [9], [10]. The ubiquity of mobile creates opportunities for programmes focused on increasing affordable Internet access, exemplified by FPW. Although there may be more affordable, sustainable and scalable models for bridging the digital divide than telecentres built around shared PCs and landline connectivity, it is not yet clear that mobile phone-only models are a full substitute [11].

Telecentres have long been the cornerstone of Government programmes to address the digital divide and foster economic development [12]. The South African government across local, provincial, and national spheres is making massive investments in broadband networks and FPW access to catalyse economic development and narrow the digital divide [10], [13]. A specific challenge for ICT for development (ICT4D) practitioners in telecentre programmes is to establish the impact FPW programmes have on these telecentres and the opportunities FPW provides to augment telecentres.

This research project aims to examine some of these questions through an exploration of the effect of FPW use on the behaviour of existing telecentre users.

The research is expected to benefit researchers, government, and citizens. Researchers benefit from corroboration of previous findings and, the establishment of a repeatable collection procedure for future observation of the impact of FPW rollout on telecentres usage. Government and other organisations implementing FPW at telecentres can benefit from insights into why users choose to use FPW. Citizens and residents of disadvantaged communities may benefit from changes in telecentre and FPW programmes resulting from insights gleaned from the research.

The paper proceeds as follows. In section two a literature-based background to telecentre use is provided. In section three, an overview of the research design is presented followed by the research findings in section four. Section five discusses the findings and concludes the paper.

2 Background

Despite the promises of advancing technology, inequity remains in the world [5] manifested as inequality in people's capabilities [14]. Improvement of capabilities is a common goal of development including in South Africa whose constitution states the aim of improving quality of life by releasing each citizen's potential.

Sen's Capability Approach (CA) [15] provides a theoretical lens from which to view the development of people based on the capability of individuals to live the lives they value [14]. Within CA development is defined as the freedom to enjoy their life, in contrast, to merely increasing wealth and consumption of commodities (resourcism), or subjective well-being (utilitarianism). A person's quality of life is understood regarding functionings or states of being, such as being in good health, and capabilities as the set of desirable states of being an individual can access. Importantly, the individual has the agency to pursue their interests [16]. In this sense, functionings are capabilities that the agent enacts through choice.

Regarding CA, lack of access to ICT and the skills to use them is a corrosive disadvantage that reinforces other disadvantages and causes further disadvantage [17]. Conversely, those with access to ICT and the skills to use them effectively enjoy a fertile functioning which increases both their knowledge of available opportunities and their ability to capitalise on opportunities, for example, using online marketplaces to sell craft goods or benefiting from open access online courses. Literature shows that ICT skills are fundamental to socio-economic development [12] and globally increased availability and uptake of ICT is viewed as an enabler of economic growth and development [6].

However, development is inhibited by poverty, by which we mean limited life expectancy, education, and income, which is also a potent disadvantage in contemporary South Africa. A consideration of the nature of disadvantage must include the historical effects of earlier policies which sought to segregate population groups politically, economically, socially, and spatially.

The segregation policies in Apartheid South Africa gave rise to high levels of poverty particularly among Black African and Coloured South Africans. Poverty has been significantly reduced over the past two decades, but South African continues to have one of the highest rates of wealth inequality in the world [18].

The most disadvantaged communities in South Africa, remain underserviced and geographically removed from city centres, with limited access to facilities for residents [9]. This definition of disadvantaged communities is adopted in this paper, recognising that there is no precise definition and that population density, informality, and poverty levels vary significantly within and between these communities.

2.1 Telecentres

Telecentres are part of a PAC ecosystem aimed at segments of the population who are unable to afford their own ICT devices [19]. Telecentres may provide access to the Internet, desktop computers and equipment and services such as scanning, printing, copying, and computer training. As telecentre definitions vary between authors [2], [20], this paper differentiates cybercafés, libraries, and telecentres regarding the funding model, core mandate, and training service offerings.

Cybercafés, or Internet cafés, are commercial ventures that provide PAC for a fee but are rare in the more impoverished areas of South Africa [20]. A survey of PAC across 25 developing countries, including South Africa, found an average of six to seven cybercafés – mostly in urban areas – for every library or telecentre [1]. Funded by government and development agencies, free PAC venues such as telecentres and libraries play a significant role in rural and underserviced areas [1]. However, they differ in core mandate and focus – primarily providing access to technology or both access to technology and opportunities to acquire skills to use the technology.

While some libraries provide computer and Internet access [21], these are often structured around the needs of users who are searching for information with short session limits [22]. In addition, computer literacy limits access for some individuals [23].

Telecentres, in contrast to libraries, have a developmental mandate to address both ICT access and use skills [19]. Free training in basic computer literacy and Internet skills and assistance from telecentre staff are generally available at telecentres. Telecentres may also offer additional services such as job placement and access to distance learning [21]. Telecentres are usually established in rural and disadvantaged communities frequently hosted by or attached to libraries, schools, churches, clinics, youth centres and similar facilities [20].

However, telecentres have not been able to scale to the millions of access points required [3] while cost, sustainability, scalability and evaluation issues have stymied telecentre programmes. Connecting remote rural areas, sometimes requiring the provision of electricity and sanitation, entails significant expense with high telecommunications cost and poor coverage in some areas [4], [11]. This is exacerbated by remote telecentres serving relatively small numbers of people which increases per capita costs.

Although, extensive survey studies have been conducted into the use of telecentre facilities internationally [1], [2], [21] and locally [12], [24], [25], evaluation of their impact has not been uniformly objective [23], [26] nor do existing evaluation practices provide insight into how users use the telecentres [12] being typically evaluated as the number of times the technology is accessed.

Use of telecentres can be considered from several levels of activity, such as the affordances of the technology and the rules around its use [22], [27], the nature of the task as hedonic (related to pleasure and experience) or instrumental (related to the achievement of specific outcomes) [23], the frequency of use of the telecentre, or the importance users assign to the activity [12].

Studies conducted in the global South have observed activities such as browsing and searching the web [11], [12]; using email [11]; social networking [12], [23]; interacting via instant messaging (IM) or voice over IP (VOIP) [11]; editing media captured with their phones [28]; uploading photos to social media [12], [22]; creating and editing documents, spreadsheets, and presentations [12], [22] printing [28] and scanning; reading about current events or the news online – including sports and entertainment news [22], [23]; streaming videos [11]; downloading music or other media to phones or storage devices for later use [11], [29]; playing games [11], [30]; banking or shopping online [11], [23]; completing online applications [23] for example for tertiary education, bursaries, or jobs; charging phones [29]; socialising with friends and sharing ICT accessories [29]; and helping or being helped by other users [29].

The ability of users to convert technology into capabilities is limited by the affordances they perceive. The concept of affordance derived initially from perceptual psychology but taken up in the field of information systems (IS), relates the user's environment to possibilities for goal-directed action that the user perceives in the technology. Thus, an affordance is the properties that provide an actor with the capability to use the technology [31]. In IS, an affordance has at least three properties: firstly, it is the potential for action and not the action itself; secondly, it resides in the relation between the actor and object; and thirdly, it impacts directly on behaviour [32]. Like a lack of capabilities in the user, the lack of affordances in the technology may require external assistance to make the technology accessible to users or to enable users to perceive its potential in their lives. Learning through expanding the perceived affordances of ICT and observation of others' use of ICT in a shared setting is an inherent benefit of telecentres [2].

Equipment, bandwidth, staffing, and available physical space for telecentres are limited, and, consequently, rules are introduced and services rationed. With demand typically exceeding supply, telecentres impose time limits on access. Services, such as printing and copying, may be limited regarding the number of units per day [21], [29]. Thus, users access to telecentres may be constrained by the operational realities of the telecentre. Furthermore, where telecentres are far from some people's workplaces and homes, users may need to travel long distances or through dangerous areas [29].

These factors may enforce constraints on the typical user. A global impact study of 5010 PAC users in five developing countries (not including South Africa) [21], found that the majority of PAC users: make use of the venues multiple times per week; are males between 16 and 25 years old; have no other option for computer and Internet access; have mobile phones; and are moderately educated with 80% holding a secondary school qualification or higher.

A similar study of 2274 PAC users in Cape Town revealed that most users were male youths, two-thirds of whom hold a secondary school certificate and 40% of users were unemployed and another 30% are students [12]. Self-reported reasons for using the PAC venues included: free to use [12], [22], [23], [29]; access to equipment not available at home or elsewhere [2], [23], [28]; access to training and informal learning opportunities [2], [12], [23]; a place to socialise and share experience [2], [22], [23], [29]; and a safe physical space [29].

2.2 Smartphones

Smartphones are portable handheld computers that combine the telephony functions of cellular phones with functionality enabled by the always-on Internet and advanced mobile applications and online services [33]. The

advantage of smartphones over other computers is their portability and versatility [34]. South Africans have adopted smartphones rapidly in a context of low penetration of PCs and broadband connectivity [33]. The growing number of disadvantaged people who own smartphones and use the mobile Internet [8], [11], [22], [23], [24] has led to the view that telecentres are becoming irrelevant [2].

While smartphones provide adequate access to the Internet [10] and can be leveraged to produce images, videos, and audio [34], some tasks – such as preparation of long documents, editing images and video, and creating presentations – are better fitted to the affordances provided by the larger screens and keyboards of desktop computers [11].

Nevertheless, the high cost of mobile data is an inhibiting factor in the use of smartphones [22], and free public Wi-Fi hotspots provide mobile users with the means to use their devices for online tasks without the expense of mobile Internet [9], [10].

2.3 Free Public Wi-Fi

Free public Wi-Fi has been debated as a solution to the problems of low broadband penetration and inequitable access in South Africa [10]. However, existing projects have not been as successful as envisaged [10]. The networks have become congested resulting in poor user experience while in cities where most users had alternative connectivity options the public costs were not justified by the benefits [35].

While the profile of a typical FPW user is similar to the typical PAC user [8], [9], [10], user experience challenges include poor network performance, lack of technical support; and, personal security when using their devices in public spaces [9], [10].

2.4 Summary

In sum, the profile of PAC users at telecentres is similar to that of free public Wi-Fi users, and yet it has been observed that FPW imposes more significant constraints on user experience, and where alternative connectivity options are available the benefits of FPW do not necessarily justify the costs.

This led to the research question: To what extent does use of free public Wi-Fi (FPW) compare to public access computer (PAC) use at telecentres?

3 Research Design and Method

A survey was used to answer the research. Twenty-five variables linked to key concepts were included in the instrument taking and took respondents an estimated ten minutes to complete. A friendly tone and simple language were used throughout the instrument to both ease comprehension and keep respondents engaged. Online self-administration allowed respondents to remain anonymous, abandon participation at any time without embarrassment or waste of resources for the researcher and allowed users to be assessed concurrently. Questionnaire presentation and response collection were via the software program Qualtrics.

The target population was the users of six provincial government-funded telecentres in disadvantaged communities in the Western Cape who also had access to a smartphone. These are located in wards with at least one provincial government-funded free public Wi-Fi hotspot. In the Western Cape, there are two major free telecentre programmes, Smart Cape and Cape Access, for users in the Cape Town metro and those outside the metro respectively. Smart Cape provides registered library users with computer access for up to 45 minutes per day at each City of Cape Town library. Registered members can also benefit from 100MB of free data per day when connecting to Wi-Fi at these facilities. Cape Access has 70 centres in rural and underprivileged communities across the province. The centres provide users with free access to desktop computers and the Internet (45 minutes per session), printing and scanning (10 pages per day), and accredited and informal e-skills training.

There are two major free public Wi-Fi FPW programmes in the Western Cape. As was the case with public access computing telecentre these are initiatives of the City of Cape Town and the Western Cape Government. Each programme leverages off its parent's broadband network. The City's offering is integrated with its telecentre offering under the Smart Cape umbrella. The Western Cape's programme is the Neotel Wi-Fi Internet Access Project which provides users with limited free Internet access (250 MB per device per month) at 178 hotspots across the province. Although, some NeoHotspots are located near Cape Access centres means that users with smartphones may be able to benefit from both the telecentre and free public Wi-Fi, the programmes are run independently and by different departments.

For this study, a target of one hundred complete responses with a sub-minimum of ten responses per target telecentre was set for the initial data collection. During October 2017, a desktop shortcut was placed on the

public workstations at the six telecentres. Each telecentre was provided with posters encouraging participation in the survey and users were incentivised to participate with entry into a lucky draw.

The data collected from Qualtrics were exported to SPSS for initial inspection and cleaning, and the partial cases were removed. The data were analysed, and findings are shown in the next section.

4   Data Analysis and Findings

Surveys were completed by 123 respondents of which three were discarded due to not being fully completed resulting in a net number of 120 respondents.

The majority of respondents (65%, n=78) were male, and ages of respondents ranged from 18 to 66 with the majority (55.2%; n = 64) between 16 and 25. Two thirds (66.7%; n = 80) of respondents reported matric as their highest level of education attained, one fifth (20.8%, n=25) had obtained a certificate or diploma from a vocational or trade school, and fourteen (11.7%, n=14) had a university degree. One respondent (0.8%, n=1) had no formal education.

More than half the respondents (55%, n=66) reported their occupational status as unemployed but seeking employment. Two respondents (1.7%) described themselves as unemployed not seeking employment. Amongst the employed respondents (27.6%, n=33), 14.2% (n=17) were employed part-time, 6.7% (n=8) were employed full-time and a further 6.75 (n=8) were self-employed.

The preferred languages were Afrikaans (48.3%, n=58) followed by English (35.8%, n= 43) and isiXhosa (15.0%, n=18). The majority of respondents were Coloured (60.8%, n=73) and the balance Black African (38.3%, n=46).

The majority of the respondents reported making use of the facilities multiple times per week (74.2%, n=89). Some visited at least once a week (10.8%, n=13), eight (6.7%) visited at least once a month (6.7%, n=8), and the balance rarely (8.4%, n=10). Fifteen respondents (12.5%) were first-time visitors to a telecentre.

A high percentage of respondents (97.5%; n=117) had access to a mobile phone, most of whom had exclusive use of the phone (82.5%, n=99). Of the respondents who had exclusive use of a phone (n-99), 85.9% (n=85) owned smartphones.

More than two-thirds of the respondents who own a smartphone (68.2%, n=59) were aware of an FPW hotspot near the telecentre. Of these respondents, 64.4% (n=38) were frequent FPW users which translates to only 31.7% of all respondents (n=120) and 48.1% of those respondents who are regular visitors to the telecentre (n=79).

4.1   Reasons for Visiting Telecentres

Respondents provided their primary reasons for visiting the telecentre: Internet access (27.5%, n=33); better equipment than available to them elsewhere (22.5%, n=27); assistance from other users or telecentre staff (20.0%, n=24); computer access (11.7%, n=14); to work or be with friends (7.5%, n=9). One respondent (0.8%) visited the telecentre for safety. Twelve respondents (10%) selected the 'other' option and provided reasons for job-searching, self-improvement, or both.

Respondents who were not visiting the centre for the first time (n=105) were asked to indicate how frequently they engaged in a number of activities when visiting the telecentre. The results are summarised in Table 1.

Table 1. The frequency of Telecentre Activities

Task	Frequent Use	N
Browse, search, or surf the Internet	88.1%	93
Email	74.3%	78
Apply for something online (e.g. job, bursary, grant)	65.3%	69
Type documents or create presentations	64.4%	68
Document printing	60.4%	63
Document scanning	49.5%	52
Read about current events or the news online	43.5%	46
Use social networks (e.g. Facebook, Instagram, Twitter)	37.6%	39

Chat using IM and/or VOIP (e.g. WhatsApp, Facebook Messenger, Skype)	27.8%	29
Transfer files (e.g. documents, videos, music) to my phone or USB stick	23.8%	25
Watch YouTube or other online videos	10.0%	11
Do online banking or shopping	6.0%	6
Listen to or download music on the computer	4.0%	4
Play computer games online or offline	2.0%	2

When visiting the telecentre, the majority of respondents browse the Internet (88.1%, n=93), use email (74.3%, n=78), do online applications (65.3, n=69), type documents or prepare presentations (64.4%, 68), and print documents (60.4%, 63). Less than half of the respondents frequently scan documents (49.5%, n=52), read online (43.5%, n=46), use social networks (37.6%, n=39), chat online (27.8%, n=29), or transfer files (23.8%, n=25). Few respondents frequently watch online videos (10.0%, n=11), shop online (6.0%, n=6), stream music (4.0%, n=4), or play online games (2.0%, n=2).

For each activity in which they did not engage, respondents were asked to indicate the reason as shown in Table 2. The primary reasons for not engaging in activity were lack of necessity (43.4%) and lack of desire (32.1%).

Table 2. Frequencies of reasons for never engaging in an activity at the telecentre.

Reason for Never Doing Activity	Percent	N
I do not need to	43.4%	265
I do not want to	32.1%	196
It is not allowed	13.1%	80
It is not possible	6.5%	40
I do not know how	4.9%	30
Total	100.0%	611

Respondents who had indicated they had connected their phones to FPW (n=68) were asked to select reasons they had they had done so. The most frequently selected option chosen by respondents was "It is free" (64.7%, n=44).

4.2 Comparison of FPW Users and Non-FPW Users

A Mann-Whitney U test determined no significant difference in telecentre use frequency between smartphone owners who frequently used FPW and those who did not use FPW frequently.

A chi-square test of independence was conducted between all smartphones owners who were frequent FPW users and the thematically coded main reasons for visiting the telecentre. There was no statistically significant association between FPW frequency and main thematic reason, $\chi2(3) = 3.445$, p = .327 with a small association with Cramer's V = .202.

Mann-Whitney U tests were run to determine if there were differences in telecentre activity frequencies between smartphone owners who frequently used FPW and those that did not. Only the frequency of online banking or shopping differed significantly between the two groups. The median frequency of online banking or shopping was statistically significantly lower for frequent FPW users (mean rank = 28.38) than for other smartphone owners (mean rank = 36.57), U = 400, z = -2.181, p = 0.029. Thus, users of telecentres who own a smartphone had lower use of the provided computers than those that did not. As the activities performed on smartphones using FPW have not been determined yet, it was not determined whether the FPW users used their own devices for online banking and shopping.

5   Discussion and Conclusion

The study set out to explore the extent to which the use of FPW compares to public access computer use at telecentres in the Western Cape, South Africa. The study found similarities between telecentre users and FPW users but highlighted the difficulty of determining applications that are accessed over FPW. A related observation noted the higher use of online banking and shopping by telecentre users without smartphone access when compared to those with access.

These findings resonate with empirical research of the profile of telecentre users and FPW users regarding mobile phone ownership, other means of access to ICTs, the frequency of use, gender, and age. The majority of telecentre users had mobile phones which are primarily smartphones. Many participants saw the telecentres as their only option for Internet access while some had no other option for computer access. The majority of respondents visiting the telecentres did so multiple times per week and were primarily unemployed males under twenty-five years of age. The telecentre user profile closely matched that of FPW users.

The reasons for visiting telecentres also matched the literature with most respondents using the telecentres mainly for the equipment and network connectivity. A fifth of users came to the telecentre for training or help which is lower than expected given the local telecentres emphasis on training and support.

In contrast to some studies, few respondents indicated that they visited the centres for reasons of physical safety, which is surprising given the high crime rate in South Africa.

The type of activities undertaken by users at telecentres was similar to other studies with visits including Internet searching or browsing, emailing, creating documents, scanning, printing, and completing online applications. In contrast to other research, less than half of visits included social networking, online chatting or reading news. One possible reason for the lower finding may be privacy concerns of respondents due to the necessity of pervasive surveillance at the telecentres with telecentre managers able to view the activity on any workstation at will. Likewise, rules against hedonic use, such as watching videos, listening to music, and playing games, were enforced in some telecentres.

Rules against hedonistic use may also be responsible for the limited use of smartphones reported for chatting or messaging or listening to music while using the telecentre computers even though a large percentage of respondents had access to smartphones.

Nevertheless, from a CA perspective, the high percentage of respondents listing lack of need or lack of desire as reasons for not undertaking activities shows their high level of choice. Consequently, through choosing not to make use of the provided capabilities, they enacted a form of functioning.

While most smartphone users had used FPW at least once, they were not frequent FPW users. The principal reason for using FPW was free access while other reasons included faster access speed and avoiding waiting for access to the telecentre computers.

Telecentre use differed between FPW users and non-FPW users in the use of online banking and shopping which was more frequently used by non-FPW users. As the activities performed on smartphones using FPW have not been determined yet, we assume that telecentre users with smartphones use their own devices for online banking and shopping.

The reason for the decreased use of FPW for these activities may be as a result of the pervasive surveillance and privacy concerns at the telecentres. Research is required to verify this. Further research is required to identify if the limited use of FPW is common in South Africa as well as the extent to which the pervasive surveillance and privacy concerns at the telecentres are responsible for the difference in FPW and telecentre use.

A limitation of the research is the unresolved determination of the activities that FPW users perform on their own devices. A further limitation is in the study being undertaken at Western Cape telecentres and during office hours. From a CA perspective, access to the telecentres indicates a level of functioning in the respondents that may not be available to other members of disadvantaged communities in the Western Cape. Consequently, the findings may not be generalisable to other telecentres, for instance, those telecentres that operate outside of regular office hours.

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Rethinking Technology Enabled Development: A Critique of the Neo-Liberal Perspective Embedded in ICT4D Studies.

Calisto Kondowe[1] [0000-0002-0845-3157] and Wallace Chigona[2] [0000-0002-1059-811X]

[1]University of Cape Town, Cape Town, South Africa
[2]University of Cape Town, Cape Town, South Africa
kcalistos@gmail.com

Abstract. The question of how Information and Communication Technologies (ICTs) contribute to development remains elusive. Moreover, while literature agrees that there is no clear-cut understanding regarding the role played by ICTs in development, it is clear that they have transformed and revolutionised the theory and practice of global development. Narratives in information and communications technology for development (ICT4D) research imply that ICTs are catalysts and enablers of development. Although a number of studies point to the complex nature of the relationship, less work has been done towards analysing and explaining this relationship. Moreover, there is less work in ICT4D studies elaborating on the complex nature of development itself. This study is a critical discourse analysis of multidisciplinary literature on ICT4D. The study argues that technology-enabled development is conceived within the neo-liberal school which emphasises economic growth and capital accumulation while the benefits of these two are assumed to trickle down to the masses. To argue for development in neo-liberal terms is ambiguous as the ways in which ICT enables economic growth can reinforce underdevelopment and uneven development. There is thus a need to move away from the narrow justifications of ICTs within the neo-liberal terms if better narratives for technology-enabled development are to be sought.

Keywords: Technology enabled development, ICT4D, economic development, development,

development studies.

1. Introduction

Research and practice of ICT4D have been centred on creating the conditions under which development can be realised using digital technology, especially in the developing world. There are critical questions that have been raised recently as to whether ICTs contribute towards development and whether the developing world would benefit from ICTs. Scholars are thus divided into two camps regarding the role of ICTs in development and no single approach has been agreed upon. The discipline is faced with complex and often antagonistic viewpoints on technology-enabled development. Scholars are yet to agree on the position of ICT in development. On the one hand, technology optimists argue that ICTs offer opportunities for development of developing nations e.g. [54, 71, 77], while, on the other hand, technology pessimists argue that ICTs reinforce inequality and precipitate new forms of marginalisation. This study argues from the onset that debates in development thinking are complex and there is a need to engage with development theory for a comprehensive analysis of technology-enabled development. A clearer understanding of development studies is critical in ICT4D studies for a clearer articulation of the relationship between ICT and development.

ICTs are now at the heart of global development discourse. They are portrayed as a catalyst and a tool that can enable development and that has many positive contributions to global development [2, 77]. Although the relationship between ICT and development is acknowledged as complex, beyond acknowledgement, the complexity is underspecified and there have not been many studies aimed at uncovering this complex relationship. These studies are based on the underlying assumption that ICT can contribute to the improvement of socioeconomic conditions of the poor e.g. [6, 18, 59]. Moreover, they identify the role of ICT as a tool to leverage social transformation and economic development, including empowerment, poverty eradication and growth e.g. [40, 41, 42]. These studies echo the assumption that development is a product of accelerated ICT adoption and use. Thus debates about whether ICTs are vital for tackling developmental challenges have an almost certain and clear answer that these technological solutions have a developmental potential. The challenge with the positioning of ICTs in development debates is that they are anchored within the neo-liberal school and a deeper analysis of neo-liberal economics would reflect that they have reinforced poverty and inequality. Though these narratives

imply that ICT has transformed global development, this positive glorification of ICTs fails to answer the major question of how ICTs contribute to development and the nature of development that they target.

Development is in itself complex and, over time, the thinking has been crafted upon an antagonistic continuum with orthodox development thinkers, on the one hand, merely basing their studies on a neo-liberal stance, emphasising economic growth, and the normative development thinkers, who emphasise human development, on the other. These two paradigms complicate the question of the nature of development that ICT4D targets and raise questions as to whether ICT as a tool for economic growth within the neo-liberal perspective can contribute to development.

Although development thinking should be applauded with significant scholars witnessing conceptualisations incorporating human development following Sen [63]'s ground breaking capability approach, among other approaches, to development that focused on empowerment. Moreover, millennium development goals and human development reports were adopted by the United Nations to track practice were associated with human development. As positive as steps such as these appeared on the surface, these developments, according to Clarke, Wylie & Zomer [14], prioritised reducing extreme poverty; however, they remained compatible with neo-liberal growth economics. By focusing on people as the ends of development rather than the means to get there [21], economic development is still seen as a means by which development can be achieved. Neo-liberal theories to date occupy a huge space in development studies, while human development frameworks still struggle to find space. Despite scholarly research and recent developments in the field, to date human development has gained less traction to be positioned as a means of development and remains as an outcome of economic growth. With this scholarly and theoretical struggle in development schools of thought, ICT4D as a field may have inherited the same traits; hence there is a need for these studies to engage with development ideas within micro and macro development dynamics. Development thinking to date, however, is still dominated by excessive pre-occupation with economic orthodoxy, led by the dominant international economic institutions, notably the International Monetary Fund (IMF), the World Trade Organization (WTO) and the World Bank [44]. These organisations have, since inception, been pushing for neo-liberal development practice. Although this approach can lead to economic development, the dependency theorists and other critics of neo-liberal economics have argued that neo-liberalism is the major cause for underdevelopment and uneven development. In spite of the critiques, the neo-liberal approach still occupies too much of the centre stage in global development. This neo-liberal approach sets the framework for many development projects including ICT4D which may be the main reason why ICTs have failed to deliver on development.

It is within this complex history within development studies that I discuss current perceptions and understanding of the role of ICT in development which rests primarily within the neo-liberal school. I further discuss the implications of conceptualising ICTs within the neo-liberal development school. Although there are developments towards acknowledgement of human development, the debates in ICT4D are mirroring and reinforcing traditional debates in development studies. The study supports the view that ICT4D debates are based on faulty assumptions and that there is a narrow discussion and engagement with development theory. Under-specification of development theory poses a number of challenges in ICT4D research, one of which is the over-glorification and over-emphasis of the role of ICTs in development. A neo-liberal view of the role of ICTs and development falls short in justifying ICTs as a tool for development.

2. Understanding Development Studies/Theory

It is critical to reiterate that the way researchers analyse the relationship of ICT and development depends a great deal on how they understand development itself. Concern over development has been at the core of theory and practice for decades. Development studies are complex; there is no agreed way of analysing development. Scholars and practitioners thus face critical choices regarding focus, scale and expertise [16]. Conceptualisations of development have been diverse. The field has been preoccupied with analysing the existence of poverty and inequalities in societies [53]. Development studies are multidisciplinary and have, for several decades, been connecting different thinkers in different fields, such as economics, sociology and history, amongst others. Early conceptualisations have been based on development as purely economic growth within the neo-liberal school until recently when the field witnessed the nature of explanation shifting from merely economic growth to other aspects in socio-economic development. Recently development studies are engaging with several issues around environment management, peace, and climate change, among other critical concerns. Moreover, it is seen as the improvement of human wellbeing, condition or welfare. Although there have been shifts in development studies from economic growth to human development as new developments and new frameworks forged some kind of consensus by prioritising reducing extreme poverty, they remained compatible with neo-liberal growth economics [14]. Development studies are thus embedded within orthodox and neo-liberal thinking. This study will discuss the orthodox approach which is mainly in the neo-liberal school.

2.1 The Neo-liberal Development Thinking within the Orthodox Approach

The orthodox approach refers to the early conceptualisation of development which was primarily preoccupied with economic growth [55]. This was the thinking that emerged after World War II as independent countries sought advice for the acceleration of their development [56]. During that time, the Western world was confronted with the challenge of rebuilding countries that had been destroyed by war. The main international player at the time was the International Bank for Reconstruction and Development (now known as the World Bank), created to lead in this task. During this time there was also a concern regarding the challenges alongside facing backward regions and countries, and the solution that was devised was that these challenges could only be overcome through the pursuit of economic growth through industrialisation. The modernisation theory of Rostow [58] was the approach that was practised as the economic model of transformation from traditional or underdeveloped societies to modern or developed ones [58]. Backward countries were supposed to follow the paths that the developed countries followed for them to achieve development. Development was considered largely synonymous with industrialisation and economic growth. Technologies, new ingestions and innovations were idealised as a momentum to bring economic improvements to the less-developed and developing regions [29]. The ultimate goal was to raise incomes and, in the process, give the poor people access to the range of goods and services. Industrialisation was seen as the path to raise incomes and the benefits of economic growth were envisaged as if they would trickle down to the poor.

Capital accumulation was at the heart of development and was seen as the necessary requirement for development. This therefore primarily focused on the requirements for an increase in per capita real income. The concept of development was, in this era, conceptualised as a straightforward and linear technical intervention [37]. The goal of economic development in its simplest form was just seen as an idea of creating the wealth of a nation stimulated by the free market system. Economic growth through industrial transformation was assumed to allow poorer countries to catch up with industrial countries. The resulting growth theories assumed that wealth generated through economic growth would trickle down and eventually benefit all segments of society.

Within the neo-liberal thinking was the idea that macro-level processes had a great impact on development. Theorists in this space were preoccupied with relationships within and between the micro- and the macro-processes. The state and markets were the main actors to determine economic growth. The approach emphasised the importance of markets. The states were supposed to create an enabling environment which is market-friendly. This "growth first" strategy was based on the notion that economic growth was central for development to happen [68]. Whilst inequalities would initially be evident, it was argued, these would be temporary as, in the long run, benefits of investments into industrialisation would filter and trickle down to the lower echelons of the society thereby reducing poverty and inequality. Simply put, economic growth was seen as the means and the end of development. The benefits of economic growth in the market economy flow to all participants, be they individuals or countries. They assumed economic growth to have a redistribution effect. Although in a number of contexts neo-liberalism worked for example in in Africa, neo-liberalism reforms reaped mixed results [69]. In South Africa among other countries the poor did not benefit from the growth but the elites [62]. Moreover, neo-liberalism in Africa deepened poverty and inequality.

2.2 Challenges to the Neo-liberal Conceptualisation of Development

The neo-liberal development approach is based on the foundations of free market, free trade, and integration-building policies [56]. The author further argues that the approach is based on the idea of building a world order glowing with growth and prosperity. Despite the intellectual optimism of the early generation thinking that focusing on capital accumulation and increasing a nation's total wealth enhance its potential for reducing poverty and solving other social problems, the reality was that capital accumulation was not followed by poverty reduction and improving the human condition and wellbeing or human development. The dependency theory as the major critique of modernisation and the orthodox approach argued that modernisation was the very reason for underdevelopment [20, 61]. Leaving development in the hands of the private sector with less regulation was another problem which was seen as leading to poverty and inequality [30, 61]. Capital accumulation, especially through private hands, created monopolies which left the poor vulnerable and powerless [61]. The markets were seen as institutions that could not be trusted and could promote poverty and inequalities. The poor became vulnerable and the gap between the rich and the poor widened. A new phenomenon regarding poverty and inequality was the result of this approach: the benefits of economic growth did not trickle down to the poor. Instead, growth was achieved at the cost of greater inequality, higher unemployment, weakened democracy, loss of cultural identity, or overconsumption of natural resources needed by future generations [64]. The approach was critiqued in that it saved only the few of the society and the poor remained poor while the rich were getting richer [43]. History offers a number of contexts where economic growth was not followed by similar progress in human

development. This, however, does not serve to argue that economic growth negates human development, but further clarifies the complexity of the process of development and that the pursuit of economic growth may have negative effects on development itself.

3. Methodology

Since the aim of the study is to uncover/rethink the understanding of the relationship between ICT and development, I propose a better explanation which will in greater depth uncover the discourses within ICT-enabled development and its implications for development studies. The study is critical in its approach. Critical approaches are generally used in critical studies to examine prevailing ideologies to reveal distortions, contradictions and to also uncover the limitations of current conceptualisations. Research is space within the ICT4D domain using critical discourse analysis. A review of studies by De, Pal, Sethi, Reddy and Chitre [17] showed that only about 20% follow the critical research approach. The key concern of the study is thus interrogation of contemporary conceptualisation of technology-enabled development in order to transform the study towards being more critical and to use development studies as the lenses of analysis.

The study adopts Heeks' [27] academic journal ranking of ICT4D and drew from literature in the *Information Technologies & International Development Journal* and *Electronic Journal of Information Systems in Developing Countries.* There were 24 journal articles; fifteen and nine, respectively. The idea was to target the highly ranked journals. There are a number of studies that speak to ICT and development; the researcher, however, purposively selected to do the literature search for only two highly ranked journals. The journals were initially retrieved and the key word "development" used and almost all the articles came up. However, to have an in-depth analysis limit the search term "economic development" was used so as to retrieve articles deliberating on economic development issues. The phrase used would have to appear in the index terms for the paper. The articles were then further selected through reading the abstract of each paper until there were 24 papers used. The study as a work in progress did not intend to be exhaustive in its search but to lay the foundation of the general arguments portrayed and to spark further discussions on the role of ICTs in development. The researcher was aware that conference papers are important in such studies, and the study will also use two ICT4D conferences and the World Bank report of 2016 on global dividends. The study is part of the major PhD work in progress and will be developed using more articles to be retrieved using more searching techniques. At this stage only published papers were considered.

It is important to acknowledge that critical discourse analysis (CDA) requires extensive discussion of texts [19, 67], however, the intention for the study was to analyse the fundamental claims in each study on how it articulates technology-enabled development. I followed the CDA of Cukier, Middleton and Bauer [15]. The central focus of this methodology is on Habermas' validity claims [15, 34]. I aimed to identify claims in these documents using qualitative measures, and thereby explicate the hidden assumptions of claims and discourses. I thus focused on the main claims in the document about how ICTs are related to development. Bearing this aim in mind and understanding the over-glorification of ICTs in development, I was, however, aware that less attention is paid to the negative impacts that ICTs have had. It is becoming widespread that ICTs have not delivered on their promises but rather reinforced inequalities and poverty, which all called for a critical engagement to the study. Critical theorists in ICT studies do not only focus on the positive contributions of technologies to development but also question its negative impacts on society. It is from this viewpoint that the critical approach was relevant for the study.

4. Landscape of Technology-Enabled Development

As already alluded to, development is complex in both theory and practice. Moreover, policies for economic growth and development are widely contested in in this field too. Within this messy and tumultuous field, ICT4D should be applauded, as the field recently witnessed the use of many derivative frameworks: for example, the capability approach, millennium development goals for example by Clarke, Wylie and Zomer [14] and Kleine's Choice Framework. These frameworks are now increasingly adopted by researchers and international agencies [41]. These frameworks have been essential analysing the role of technology to different contexts. Although, this is a positive move towards moving from orientation towards economic growth, other theories, such as the capability approach, have been critiqued as philosophically profound but methodologically vague [79]. Despite these positive developments that ICTs can bring in certain contexts, Walsham [79] notes that beneficiaries of these interventions are never the poorest or most disadvantaged groups. Further critique on such approaches is thus required.

The new frameworks and approaches adopted are normally limited to dynamics of technology which can be localised in a specific context (for example, and technology empowering fishermen in India by Abraham [1].

Not disregarding this contribution, however, these studies fall short in dealing with complexity and controversies around development [3]. Much of this literature does not address the question of what is meant by development (for example, Avgerou [3] and Thompson [67]). Walsham [79] notes that that it is difficult to scale up initiatives to have effects throughout. This supports the fact that the progress is questionable in transforming the development landscape on the broader scale. This stems from the use of frameworks and remaining silent about how macro-economic ideologies and practices can influence a development outcome even in micro-contexts. Development debates have been argued in both micro- and macro-context; however, controversies and conflicts have, throughout history, been about development ideas/ideologies. These debates have been conducted at macro-levels around two complex concepts: human development and economic growth. I thus argue that despite the remarkable contribution in ICT4D studies, these frameworks and conceptualisations did not come with a deeper questioning and analysis of economic growth as a foundational assumption of development. They inherited the skewed orthodox and neo-liberal stance depicted in development studies to date.

5. ICT4D within the Orthodoxy and Neo-liberal School

Although ICT4D is in ferment regarding the role of technology, and despite remarkable developments in the field on engaging with human development, the discourse of technology-enabled development to date is embedded in the underlying claim that ICTs are enablers of economic growth. Markets are thus seen as important in delivering growth. Considerable pen and paper in the field has been spent on explaining ICTs as a tool to support firms' innovation [23] and supporting entrepreneurs and businesses [1] among other business-related benefits. The use of ICTs in firms is seen as a tool to enhance productivity and efficiency which can spark profits, which is essential for economic growth. ICTs have led to changes in interaction, economic and business practices, amongst others [60]. The role of ICTs in enabling economic growth is driven from its potential to unlock the potential of businesses through enabling innovation, productivity, and efficiency, which, in turn, can boost profits, which are necessary for GDP growth [1, 52]. These three ways lead to expanding trade, increasing capital and labour utilisation, and intensifying competition [57]. Growth can be accelerated directly through boosting productivity by introducing demands, making communication between firms easier and improving access to market information, and indirectly, as these aforementioned benefits are assumed to contribute to more trade, better capital use and greater competition. The studies in question portray ICTs as a catalyst to enhance business performance, boost trade, instil competition among businesses and promote better capital use [11, 32]. These efficiencies and innovations that are sparked by the use of ICTs are seen as ones to boost the GDP, which in turn, will have a redistribution effect [52, 57]. Studies are thus latent and sometimes manifest in their articulation that digital technologies can accelerate growth. These observations are in line with the broad ways that ICTs can promote development which is growth [78].

ICTs are also seen as tools that can enhance cost optimisation for firms. Beyond productivity, these technologies are said to reduce business operational costs and hence will enhance profit growth [1]. The idea is also widely supported in literature that ICTs provide a more efficient information flow that facilitates the interaction among businesses as economic agents under complex and uncertain circumstances, and reduce transaction costs [12, 35]. The main examples of cost optimisation for business are found on Alibaba's business-to-business e-commerce site which is a revolutionary ecommerce innovation that contributed to reduced coordination costs and boosted efficiency in China's economy and beyond its borders [78]. Organisations are more connected in the current economic landscape due to ICTs and this connection is said to contribute to productivity [78]. The reality is that global productivity growth has slowed in spite of investments in ICTs and the content and information that are available [22]. Studies thus fail to show whether access to information is critical for global growth.

In terms of telecoms, ICTs are said to encourage growth in income which allows for investment in telecoms [32]. ICTs also promote demands in the telecoms infrastructure, which can lead to economic growth. The investments that were made in the telecommunications sector have led to a significant growth in the telecommunications and the telecoms infrastructure [11]. The sector is one of the major drivers of economic growth underpinning many other critical sectors. This infrastructure is critical in enabling local markets into the global marketplace, increasing the number of buyers and sellers, and increasing the amount of information with which they can make economic decisions [32]. Reinforcing the findings of Woods [76] and Lee and Khatri [31] about positive contribution of ICT production and capital to growth, Piatkowski [52] claims the case was similar in the USA. ICTs have contributed to better productivity within organisations, Department of Labor (2004 in [52]) states that labour productivity growth in the United States during 1995–2004 was doubled in the previous two decades due to technology adoption. Moreover, ICTs can unleash innovation by opening new domains of activity and also through transforming the division of labour in existing domains of activity [51]. The potential of ICTs is thus to directly and indirectly promote growth.

From an economic growth perspective, whether implied or direct, scholars claim that ICTs-adoption can lead to information flows which are critical and can be used by businesses [1, 11, 32]. As communication is a highly essential element for any business, ICTs are seen as important in that they improve information flow and reduce search costs, which contribute to market efficiency and profit [1]. The studies on the women farmers in Lesotho by Vincent and Cull (2013) and on the fishermen in India by Abraham [1] showed that ICTs, especially mobile technology, improved the effectiveness of communication between the participants themselves and their stakeholders. Communication was thus important for them in order to stay immersed in market information. ICTs thus enable groups to make informed decisions based on a continuous supply of information, lowering market risks and uncertainty [1, 11, 32]. Beyond just reduced communication costs and transportation costs and transaction costs, this led indirectly to increased sales. It is thus clear that ICTs increased the productivity of firms at a micro-level and, at a macro-level, the productivity of the nations.

From the above, it is implied that technology-enabled development can contribute to development by fast-tracking economic growth through improving the performance of major economic players which are private corporations. Many ways that have been postulated as direct contributions of ICTs to development and been associated with economic growth are: GDP growth, trade promotion, and firm productivity, among others. The assumption is that, if there are investments in ICTs, economic growth will be the return of investment [48]. Through improved access to information, ICTs can result in improved market competitiveness of a nation's products and services and can provide opportunities for innovation, market expansion, capital utilisation, cost containment and profit maximisation for organisations [77]. ICTs thus can impact positively on productivity and efficiency of firms which, in turn, can lead to the growth of national economies. This reinforces the claim that technology-enabled development is conceptualised within the orthodox school. It furthers the central role of markets in development and the growth first models and capital accumulation.

6. Globalisation and ICTs

The other way in which ICTs are conceived is the way that they are promoters of the so-called world market. The concept of globalisation is complex and there is not an agreed definition; however, this is not mere rhetoric but a representation of the present state of affairs, as is reflected in the growth of world trade, unification of capital markets, internationalisation of production, distribution networks and the ICTs mega-revolution [50]. Globalisation as a critical component to development is a widely-held belief within the neo-liberal school. It is a force for liberal economics where the main aim is the formation of one world market which is not restricted by state boundaries [38]. Increased information has aided globalisation [50]. At a basic level ICTs widened and deepened interconnectedness of people and companies globally, which makes it a catalyst for the process.

The globalisation process that ICTs intensify is a controversial concept in development studies. At a basic level, globalisation has been seen as the widening, deepening interconnectedness of people and companies due to ICTs; however, it has been questioned with regard to how it can contribute to development of developing countries. Globalisation has been seen as the promotion of one market for the world and increased wealth in these developing economies [9]. This is facilitated by the use of ICTs as tools which enhance dynamic changes in the global economy through the production of networks and platforms to enhance global trade and its local outcomes. Although globalisation is seen in the economic growth perspective as a positive move, the uneven and often unjust outcomes of globalisation have been critiqued.

Although there are a number of opportunities for development that ICT-enabled globalisation has offered, the process is deeply controversial and is contested. While, on the one hand, ICT innovations are viewed as a central driving force for globalisation [66] on the other, globalisation has long been critiqued in precipitating, poverty, inequality and exclusion [13]. While proponents of globalisation argue that it allows poor countries and their citizens to develop economically and raise their standards of living through trading in the so-called international market/world market, however, globalisation has to date been associated with underdevelopment as it creates an unfair international market which has benefited multinational corporations in the Western world at the expense of local enterprises, local cultures, and common people [13]. They have argued that, instead of bringing development, the opposite has been happening. In the context of globalisation it thus becomes difficult to justify the positive impact that ICTs have contributed as there are a number of elements of domination and uneven development which are seen in the process.

It has been argued that, through the creation of one market and the use of ICTs in enhancing globalisation, the World Bank and IMF, being the key agencies leading in the process, have been the greatest purveyors of poverty around the world, despite their rhetorical claims to the opposite [13]. Moreover, inequalities in some regions have deepened [49]. The analysis shows that there has been globalisation of poverty rather than globalisation of trade. Furthermore, the process was described as a whirlwind of relentless and disruptive change

which leaves governments helpless and a trail of economic, social, cultural and environmental problems in its wake [9]. Instead of development, technology-enabled development within the neo-liberal paradigm can contribute to underdevelopment.

Although globalisation has worked for the corporations and countries in the developed economies, it is not necessarily a solution to high levels of poverty and inequality; it has been criticised as it perpetrates global inequalities. It has long been noted that developing countries do not benefit from the global market [36]. To claim that ICTs have contributed to development since they enhanced globalisation is to miss the negative effects of globalisation. It is not a panacea for development; there are no clear economic benefits for developing countries. Rather, they are left vulnerable and are exploited in the face of the unequal rules of the global market. Global markets have been criticised as they can provoke collusions that block the potential benefits of competition to poor nations and the disadvantaged easily fall outside distributional coalitions. Global markets, thus, are biased in favour of developed countries [36]. The rules of the game are that the more affluent and powerful countries dominate the global markets and exclude the poor countries from participating. It can thus be claimed that ICTs as an enabler of development through globalisation raise more questions than provide answers.

7. A Critique of ICTs within the Neo-liberal and Globalisation school

Having discussed the above narratives showcasing ICTs at the heart of current global capitalism, analysing them within the neo-liberal school is important. ICTs, in the way that they are promoting economic growth, are central in globalisation. Through ICTs it is generally accepted that the world is currently engaged in a process of globalisation. ICTs are crafted within the capitalist system as at play where the idea of ICTs is crafted in the idea of profits [10]. There is a need to acknowledge the fact that the international economic system and the activities of multinational corporations create severe, disproportionate burdens for poorer nations [47]. The ICT space has also contributed to ICT monopolies [7]. These monopolies, however, mainly benefit the developed countries which own them. These ideas can surface if development theories/ideas are used as lenses in ICT4D.

Although, rapid economic growth is often seen as essential for achieving a reduction in absolute poverty [70], China for example has been seen as a success story for moving a great number of its population out of poverty through economic growth [44]. However, growth has long been associated in development studies with increased income inequality; it does not automatically address the whole poverty problem. Conceptualisation of ICTs as a means to attain growth has been the main argument in ICT4D studies [10, 74,]. There have been calls for developing countries to adjust their policies so as to create conditions that are necessary to enhance ICTs adoption and use [78]. There have been calls for developing countries to invest in ICTs, and history has shown that there has been an increase in the number of investments [5, 8]; however, it is not clear whether these investments have transformed the development status of many developing countries. Investments in ICTs have not been followed by improvement in living conditions. On the contrary, the general perception is that ICTs have failed to deliver on their promise. Instead of promoting development, the opposite is happening. The role of ICTs in development is thus questioned, as what is on the ground is the reinforcement of inequalities, poverty and uneven development. Analysing ICT-enabled development on a macro-scale using development theories and moving away from context specific analysis would be important.

The question is whether economic growth that is generated from the use of ICTs will reduce poverty or improve the living conditions of the poor. Critiques of the orthodox approach to development, however, indicate that the relationship between economic growth and development is rather complex and depends largely on the role of the market forces and government's ability to redistribute the benefits of economic growth. In several contexts, however, history has proved that the benefits of economic growth cannot trickle down to the poor. Zambia for example is a recent lower middle-income country experiencing robust economic growth, however the benefits of economic growth has not been shared and poverty remains stubbornly high with a national average poverty rate of 54%, and rural poverty rate of 77% [77]. In fact, in cases where economic growth is overemphasised, poverty, inequality and underdevelopment and uneven development result. In light of the above explanation it is very difficult to applaud ICTs' contribution to development. In reality, however, the studies fail to explain the growing digital and global divide in the era of ICT-enabled development. Although there is no measurement and there is no clear link between economic growth and development, the improvement in economic growth is assumed to lead to a reduction in the skewed distribution of income between developed and developing countries and between the rich and the poor within these countries. Reality, however, has been witnessing otherwise: the gap has been widening. From development studies it is argued that economic growth does not translate to development. It actually leads to poverty and inequality. Despite the development in economic growth in some developing countries, poverty and marginalisation of the poor persists due to a number of challenges such as lack of skills, education and failure to invest in ICTs. A holistic analysis of this perceived trickle-down process is possible when the discipline deepens into engaging with development studies.

8. Conclusion and Recommendation

The study followed the post-orthodox thinkers who have argued that, although economic growth is necessary, it is not sufficient when it comes to development. We thus cannot hold up the role of ICTs in creating necessary resources for economic growth as a narrative to support that ICTs are catalysts and enablers of development. It is clear that, although economic growth is necessary, it also has negative impacts on development itself. It can be a stumbling block to development, and in light of the debates around access and affordability, the poor countries and people do not have access to ICTs. Instead of being developed they are more vulnerable, which leaves ICT's role in development questionable.

The neo-liberal development approach gave rise to the framework within which ICT4D was conceived. The results witnessed are the opposite of what development should be about. The global divide and digital divide, as well as underdevelopment, are replicating the long questioned impacts of the neo-liberal approach to development. Although ICT4D studies pertaining to technology-enabled development invoke the issue of development to a certain extent, their references to development are not comprehensive as they are not rooted within the history of development thought.

Development through ICTs is a contested field. Its focus on linking the economic returns to the productive factors, e.g. promoting productivity, efficiency and capital utilisation by firms, which in turn, would lead to socio-economic development, is problematic. The neo-liberal approach on which ICT4D studies is based deserves much critique. Within the development paradox, the neo-liberal approaches have been the major contributor to poverty, inequality and underdevelopment. There is thus a need to go beyond the neo-liberal approach if ICTs have to be justified as catalysts for development. Theoretical and practical elaborations in ICT4D thus should use development ideas/theory as the lenses. This makes development not only critical but central to the studies of ICT4D. Less grounding in development theory and processes results in studies in ICT4D lacking analytical bearings.

The current conceptualisations of the ICT-development nexus are problematic. The study echoes the sentiments of other scholars that a multidisciplinary approach to the study of ICT for development is not only necessary but also beneficial. Although there are current frameworks that are being developed and are focusing on human development aspects in ICT4D, these frameworks fall short on giving an analysis of the macro-economic and development landscape. There is thus a need for further engaging development discourses in order to explain the role of ICT in development at a macro-level.

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Mobile Education

Session Chair:

Jabulisiwe Mabila

University of South Africa, South Africa

Evaluation of the Framework for Sustainable Mobile Learning in Resource-constrained Environments in   South Africa

Jabulisiwe Mabila [0000-0002-4715-8548]

University of South Africa

mabiljp@unisa.ac.za

Marlien Herselman [0000-0003-1089-3925]

Council for Science and Industrial Research

South Africa

Abstract. Research has shown that sustaining the integration of information and communication technologies (ICTs) to support teaching and learning in government schools in resource-constrained environments in South Africa remains a challenge. Developing countries lack ICT for development (ICT4D) frameworks that are relevant to their contexts, even though it is critical to understand the context of the ICT4D project when developing such frameworks. Studies conducted to categorize and synthesize mobile learning models and frameworks, have upheld the assertion that few studies have extensively examined the dimensions that sustain mobile learning and developed frameworks for sustaining mobile learning in educational environments. The importance of sustainability of ICT4D projects has been acknowledged, however there is a lack of theoretical frameworks for guiding the sustainable implementation of developmental projects. This study is the third phase, the evaluation phase, in the development of the SFMTIS using Design Science Research (DSR) methodology. Guidelines for evaluation of utility in well-conducted DSR indicate that the utility, quality and efficacy of the artifact need to be rigorously demonstrated via well-executed evaluation methods. This article examines how the intermediate *sustainability framework for mobile technology integration in schools* (SFMTIS) artifact was evaluated in the third phase of the DSR process to develop the final SFMTIS. Face-to-face interviews were conducted with each of the seven expert reviewers who were purposively sampled and reviewers were requested to respond to a questionnaire to establish the reviewers' insights regarding the SFMTIS sustainability dimensions, and the views of the relevance, rigour, validity and utility of the framework. The research findings show that while the SFMTIS' utility was confirmed by the reviews provided by the expert reviewers, the views presented by reviewers informed the development of the final SFMTIS. Evaluation of the SFMTIS was established, aspects of the intermediate SFMTIS that required improvement were highlighted, and expert reviewers' recommendations were incorporated in the final SFMTIS.

Keywords: Design science research, evaluation, mobile technology, tablets, teaching, resource-constrained schools, sustainability.

1   Introduction

Sustaining the integration of information and communication technologies (ICTs) in order to support teaching and learning in government schools in resource-constrained environments in South Africa remains a challenge (Meyer et al. 2012). Research conducted by Mamba and Isabirye (2015) found that developing countries lack ICT for development (ICT4D) frameworks that are relevant to their contexts, and affirms the critical need to understand the context of the ICT4D project when developing these frameworks. Few studies have extensively examined the dimensions that sustain mobile learning and developed frameworks for sustaining mobile learning in educational environments (Ng and Nicholas 2013).

Categorization and synthesis of mobile learning models and frameworks by Hsu and Ching (2015), support the assertion that prior to the development of the "Framework for sustainable mobile learning in schools" and the "Person-centred sustainable model for mobile learning", there was no model of sustainable mobile learning in schools in the literature (Ng and Nicholas 2013). The latter was developed in the context of secondary education in Australia and is based on data collected at an Australian school. The application of mobile technology integration in resource-constrained environments has been widely researched, however the sustainability of mobile technology integration has received less attention.

The *sustainability framework for mobile technology integration in schools (SFMTIS)* was developed using design science research, based on research conducted in resource-constrained environments in South Africa. The SFMTIS was developed iteratively using DSR over a three year period, 2015 to 2017, in three phases starting with an initial framework, that was developed to the intermediate, and then the final SFMTIS. This study presents the third phase, the evaluation phase, in the development of the SFMTIS and the article examines how the intermediate

SFMTIS artifact was evaluated in the DSR process to develop the final SFMTIS. The DSR process' guidelines for well-conducted DSR require that the utility, quality and efficacy of the artifact be rigorously demonstrated via well-executed evaluation methods. Venable, Pries-Heje and Baskerville (Venable et al. 2012) posit that the purpose of evaluation of the designed artifact, in DSR is to establish if, the developed artifact achieves its purpose and how well, that is, its utility and efficacy towards confirming, disputing, or enhancing the design theory. In addition, evaluation enables comparison of the artifact to other designed artifacts' ability to achieve a similar purpose, and to determine any adverse consequences, weaknesses and areas for improvement (Venable et al. 2012).

2   Backgound

In this section sustainability is discussed in section 2.1, and the development of the initial and intermediate SFMTIS outlined in sections 2.2

2.1   Sustainability

Sustainability of organisational innovations occurs when new ways of operating become the norm and the underlying systems and ways of working are transformed in support (Moore et al. 2017). To be sustainable, any use of resources needs to take stock of the impact their utilisation has on the social, economic and political context of people today and in the future (WCED, 1987). There are different views to considering sustainability such as economic, institutional, social and environmental, and whether the term being considered is in relation to the short, medium, or long-term view (Meyer and Marais 2015). Sustainability is inextricably linked to basic questions of equity, fairness, social justice and greater access to a better quality of life (UNDP, 2011). Sustainable development can be considered as a dynamic process of adaptation, learning and action, rather than a destination (Sala et al. 2013).

2.2   Development of the Initial and Intermediate SFMTIS

In the first phase sustainability dimensions were synthesized to develop an *initial SFMTIS* from reviewing extant literature. Sustainability dimensions were extrapolated for the initial SFMTIS based on sustainability dimensions identified in:

-   general sustainability frameworks;
-   sustainability frameworks for ICT4D implementation in resource-constrained; environments, and
-   frameworks specifically developed for mobile learning in schools.
    (Mabila et al. 2017).

The sustainability dimensions abstracted from the extant literature that were included in the initial SFMTIS were: Financial, political, cultural, technological, environmental, pedagogical and institutional dimensions. Mabila, Herselman and Biljon (2017) provide a detailed analysis of how these sustainability dimensions were extrapolated.

In the second phase a case study was utilized to demonstrate and refine the SFMTIS developed in Phase 1, and the *intermediate SFMTIS* was developed. The perspectives of teachers and district officials regarding the integration of mobile technology in their schools were obtained, and were subsequently processed to inform the further development of the framework. The teachers were trained, and had previously participated in the Information and communication technology for rural education development (ICT4RED). The data of the teachers was supplemented by including the views of four district officials from the same school district. Phase 2 of the research was conducted six months after the implementation of the ICT4RED programme. The ICT4RED initiative is a large-scale South African government research, development and implementation initiative which was carried out over a period of three years, from 2012 to 2014, at a school district in the Eastern Cape province of South Africa. The initiative investigated ways in which ICTs can be integrated into teaching and learning in rural areas. In the ICT4RED programme projectors, screens and mobikits consisting of set s of tablets were awarded to schools based on the specific achievements of educators from the schools, using the earn as you learn concept. Educators were trained through the Professional Teacher Development program (TPD) on how to teach with technology and integrate mobile tablets in their classrooms. The deployment of tablets was supported by provision of technology hardware and software for the school infrastructure and network connectivity, including WiFi equipment, safe-keeping and charging facilities as well as e-books, content server and related electronic resources (ICT4RED, 2015). Details on ICT4RED are available on the website: https://ict4red.co.za/.

The findings from the case study provided evidence which confirmed the value of the sustainability dimensions identified in literature. Financial and technical support mechanisms required for the sustainable

deployment of ICTs were highlighted. The research findings indicate that communication and coordination at all levels of the education system, micro (school), meso (school circuit and district) and macro (provincial and national) is essential for ensuring sustainability. Specific issues related to institutional challenges were highlighted in the findings. This motivated the proposition of the institutional dimension to represent the structure, processes and practices at micro, meso and macro levels of the education system. The intermediate SFMTIS was refined by applying the findings of the case study to the initial framework.
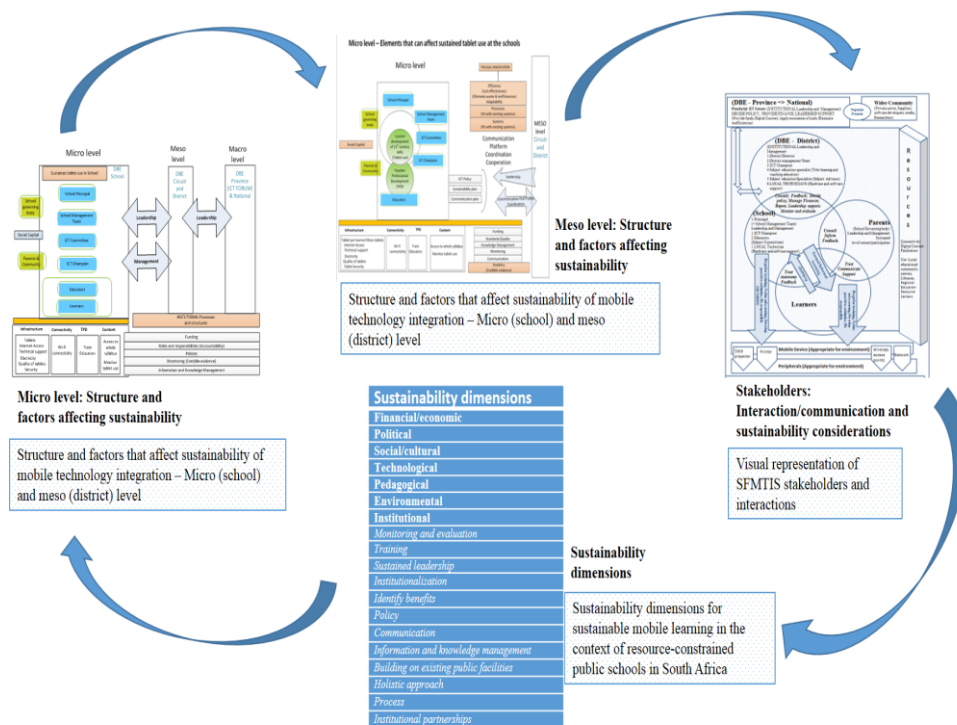
Figure 1 illustrates the *intermediate SFMTIS* which comprises of:

- Structure and factors affecting sustainability of mobile technology integration.
- Factors affecting sustainability of mobile technology integration: Micro - meso interactions.
- Visual representation of sustainability framework for mobile technology integration: context of resource-constrained environments in South Africa.
- The SFMTIS for resource-constrained environments in South Africa - dimensions and aspects to consider.

The details of the *intermediate SFMTIS* components are available on https://goo.gl/ZKe1yc.

This article focusses on the third phase, the evaluation phase, in the development of the SFMTIS using DSR methodology, and explores how the *intermediate SFMTIS* artifact was evaluated in the third phase of the DSR process to develop the *final SFMTIS*.

In Phase 3 the intermediate framework was presented to the teachers and district officials who had formerly been interviewed during the development of the SFMTIS, as well as other experienced individuals who had been involved in the implementation of the ICT4RED initiative, for their expert evaluations. The expert reviewers' feedback was applied to refine the intermediate SFMTIS and aided in the development of the final SFMTIS. The research contributes to theory by developing the theoretically grounded, evidence-based SFMTIS, thus contributing to praxis and adding new knowledge of a focal theory that addresses sustainable mobile technology integration in schools in resource-constrained environments. The study presented in this article is the third phase, the evaluation phase, in the development of the SFMTIS. The guidelines for evaluation in well-conducted DSR, specify that the utility, quality and efficacy of the artifact must be rigorously demonstrated via well-executed evaluation methods (Venable et al. 2012). This article examines how the intermediate SFMTIS artifact was evaluated in the third phase of the DSR process to develop the final SFMTIS.

Figure 1: Intermediate SFMTIS components

3 Artifact Evaluation in Design Science Research

Design science research methodology was applied in the development of the SFMTIS. Figure 2 illustrates the stages undertaken iteratively in the development of the framework. The evaluation phase, highlighted in red, is the focus of the study. This is in line with the guidelines required in well-conducted design science research (DSR) that specify that the utility, quality and efficacy of the artifact must be rigorously demonstrated via well-executed evaluation methods (Venable et al. 2012).
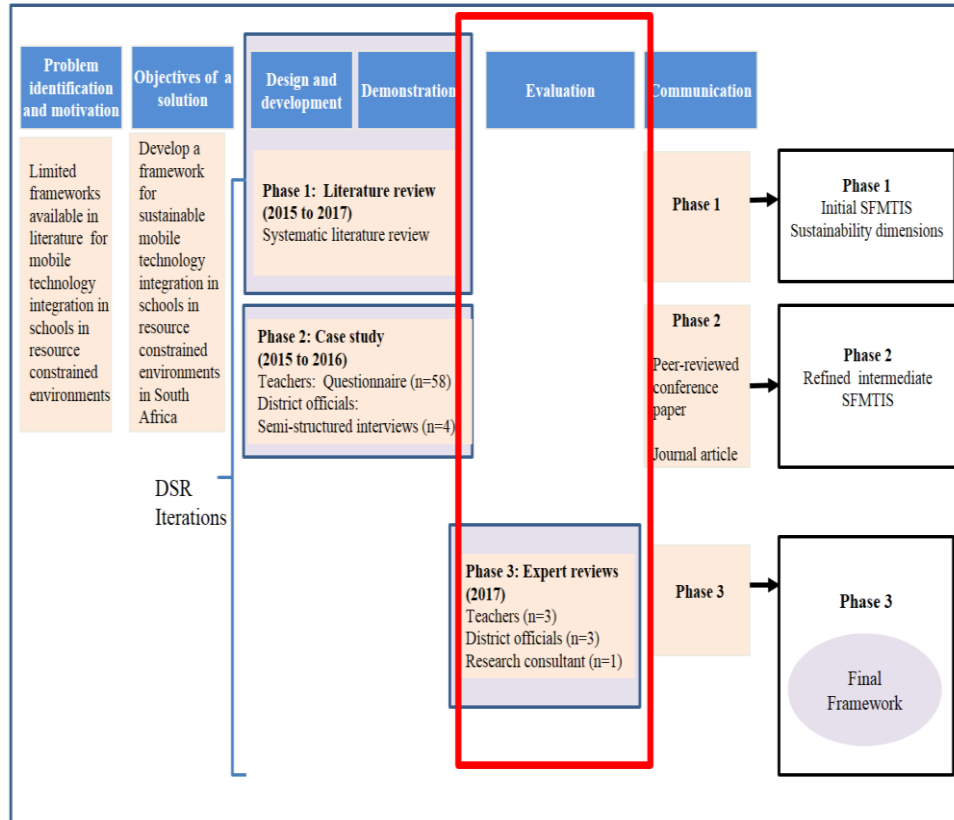
Figure 2: Phase 3 – Evaluation of SFMTIS in DSRM process (Highlighted in red)   (Mabila 2017)

DSR creates and evaluates IT artifacts intended to solve identified organisational problems (Hevner et al. 2004), and evaluating the artifact's utility in addressing the identified problems is essential, particularly where the artifact provides a type of solution, or development practices, for a particular class of user requirements (Markus 2002).

The research methodology applied in the evaluation phase is outlined in Section 4 and includes the process that was followed and the type of questions that expert reviewers answered. Findings from the expert reviews of the SFMTIS are presented and discussed in Section 5. This feedback was applied to the intermediate SFMTIS in order to develop the final SFMTIS.

4 Research Methodology

This section explains the data collection methods used in the evaluation phase and provides information regarding the expert reviewers who evaluated the *intermediate SFMTIS*.

4.1 How the Evaluation of the Intermediate SFMTIS was conducted

Face-to-face interviews were conducted with each of the seven expert evaluators. The expert reviewers consisted of three teachers (one principal and two school ICT Champions) and three district officials. These expert reviewers had participated in the ICT4RED initiative and had given input as to the development of the SFMTIS during the DSR iterations. An expert reviewer from the agency which implemented the ICT4RED initiative, the CSIR, was also requested to assess the framework. The selection of the experts was based on their knowledge and expertise

of the environment, context and involvement in the ICT4RED initiative. Section 4.2 provides information regarding the expert reviewers' qualifications and knowhow that contributed to their selection to assess the framework.

During each face-to-face interview the intermediate SFMTIS was presented and the research process that lead to the development of the SFMTIS framework was explained to the expert reviewer. Each expert reviewer was then requested to respond to a questionnaire. The questionnaire that expert reviewers responded to sought to establish the reviewers' insights regarding the SFMTIS sustainability dimensions, and the views of the relevance, rigour, validity and utility of the framework. The questionnaires utilized closed-ended questions with a Likert scale of 1 to 5, and also contained open-ended questions. The questionnaires are shown in https://goo.gl/ZKe1yc.

4.2 Information about Expert Reviewers

Table 1 presents information on the expert reviewers, their current positions and academic qualifications.

Table 3: Expert reviewers			
Expert reviewer and color ID	**Current position**	**Highest academic qualification**	**Experience**
Expert reviewer 1 - Teacher	Teacher at a school in Cofimvaba	BEd Honours (leadership and management)	Teacher for over 10 years and school ICT Champion
Expert reviewer 2 - Principal	Principal at a school in Cofimvaba	BEd Honours; Master's diploma (leadership and management)	32 years in basic education system
Expert reviewer 3 - Teacher	Head of department at a school in Cofimvaba	Primary teacher diploma; management and leadership programme	30 years in basic education system
Expert reviewer 4 - District	Senior subject education specialist (SES) at Cofimvaba district	BEd	Teacher (Maths & Science) 8 years; SES (9 years)
Expert reviewer 5 - District	Senior subject education specialist at Cofimvaba district	BEd Honours	Teacher (14 years); SES (10 years)
Expert reviewer 6 - District	Senior manager at Cofimvaba district	BEd	10 years in district, was also teacher in basic education system
Expert reviewer 7 - Academic	Research consultant	PhD	20 years

Expert reviewers 1 to 6 were all directly employed in the basic education system in South Africa, and had participated in ICT4RED. Reviewers 1 to 3 were based in schools within the area, and reviewers 4 to 6 at the district, while expert reviewer 7 had participated in the implementation of the ICT4RED as a research consultant at the Council for Scientific and Industrial Research (CSIR), the implementing agency of the ICT4RED initiative. Thus, all the reviewers were well positioned to provide an informed assessment of the SFMTIS.

4.3 Ethical Considerations

The University of South Africa's (Unisa) ethical guidelines were considered and expert reviewers' willingness to participate established after explanation of what the study entails. Individual expert reviewers signed consent forms regarding their acceptance of the request to review the intermediate SFMTIS.

5 Findings and Discussion

Expert reviewers responded to questions relating to the artifact's utility, the rigour in the process followed when developing the framework, and its relevance. The findings are presented and discussed in the following sections.

5.1 Rigour in Development of SFMTIS

Expert reviewers were asked whether they would consider the process followed in developing the SFMTIS to be rigorous. Expert reviewer 7 consented that the process followed in developing the SFMTIS was rigorous because:

"The design science research process that was followed provided a framework within which concepts could be grounded in theory and tested in practice. Iterative application of concepts in practice provided the opportunity for rigorous testing and the development of well-grounded initiatives". Expert reviewer 3 indicated that *"we were consulted after each cycle was finished".* 86% of the expert reviewers considered the process followed in developing the SFMTIS to be rigorous.

5.2 Significance of Sustainability Dimensions

Expert reviewers' responses to closed-ended questions in assessing the significance of the sustainability dimensions towards ensuring the sustainability of mobile technology integration in schools in resource-constrained environments are presented in the following sections.

Expert reviewers' views on the significance of Sustainability Dimensions to ensure the Sustainability of Mobile Technology Integration

None of the expert reviewers selected the "strongly disagree" and "disagree" options for any of the sustainability dimensions. **All** the expert reviewers strongly agreed that:

The *economic* and *cultural* dimensions are significant in ensuring the sustainability of mobile technology integration in resource-constrained schools in South Africa. One of the expert reviewers noted the importance of the role of the Department of Basic Education's district offices' role in financially supporting schools. Most of the expert reviewers, 70% *strongly agreed* and 30% *agreed* that the **political, technological and pedagogical dimensions are important for sustainability of mobile technology integration.** The environmental sustainability dimension was supported by 86% of the experts who *strongly agreed* regarding the need for making plans for maintenance of tablets, replacing damaged mobile devices, planning for eventual disposal or reuse of ICT equipment. Fourteen percent of the experts *neither agreed nor disagreed.*

All the expert reviewers *strongly agreed* that school security, communication, coordination and technical support provided to teachers are important considerations for sustainable mobile technology integration. The institutional dimension examined aspects such as security, communication, coordination, technical support, teacher professional development, leadership, monitoring and evaluation, and policy. There were 86 % expert reviewers who *strongly agreed,* and 14 % *agreed* that **professional development of teachers through ICT training is important.** It is noteworthy that one of the reviewers specified that this training needs to be made available to all teachers in the circuit and not just limited to those who had participated in the ICT4RED initiative.

Seventy one percent *strongly agree*, 14 % *agree* and 14 % *neither agree nor disagree* responses for **leadership and monitoring and evaluation**. There were 57% *strongly agree*, 29% *agree*, and 14% *neither agree nor disagree* responses for policy implementation and the use of special available facilities such as e-rate for school Internet.

Expert reviewers' views on the importance of each of the sustainability dimensions

As Figure 3 illustrates, **the financial sustainability dimension was considered to be important by all the expert reviewers**. This was followed by the pedagogical and technological sustainability dimensions at 71%; institutional at 57% and the social, political and environmental dimensions at 29%. Two of the expert reviewers, 5 and 7, viewed all of the sustainability dimensions as relevant and important.

Expert reviewer 3 stated that the financial dimension is important because *"the maintenance of the tablets is a problem".* Expert reviewers 3 and 4 also specified that security in the schools is a major problem. Levels of communication and involvement are aspects of the institutional sustainability dimension which expert reviewer 5 noted. Expert reviewer 5 indicated that the selection of appropriate technology is important.

Expert reviewer 7 stated: *"The SFMTIS tool used to score and discuss the dimensions is relevant and potentially very useful, and that the SFMTIS visual representation is useful and relevant to position the various role players".*
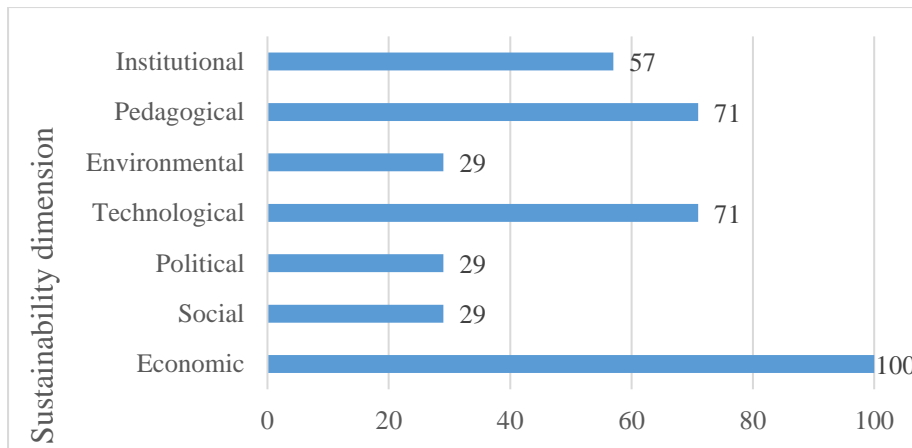
Figure 3: Percentage (%) of expert reviewers that considered the sustainability dimension as most relevant

Responses to the question: What three features of the SFMTIS would you consider as most relevant

The expert reviewers also responded to the question: What three features of the SFMTIS would you consider as most relevant? Table 2 outlines each of the expert reviewers' selection.

	1	2	3
Table 2: Expert reviewers' top three features considered to be most relevant			
Expert 1	Pedagogical	Financial	Technological
Expert 2	Pedagogical	Institutional	Financial
Expert 3	Pedagogical *("Shows if tablets are used")*	Institutional: Security	Financial *("The maintenance of the tablets is a problem")*
Expert 4	Finance	Institutional: Security *("This also shows the security which is still a problem")*	Technological *("Digital content and connectivity")*
Expert 5	All seven sustainability dimensions	Institutional: Levels of communication	Institutional: ICT policies for schools
Expert 6	Finance	Institutional: Involvement	Technological: Selection of technology
Expert 7	All the sustainability dimensions are relevant and important	The tool used to score and discuss the dimensions is relevant and potentially very useful	The SFMTIS visual representation is useful and relevant to position the various role players

The information in Table 2 indicates that pedagogical, financial, institutional and technological sustainability dimensions were prioritized by the expert reviewers.

5.3 Relevance

Expert reviewers responded to the questions: Does the SFMTIS address a real problem /need? and Would you consider the SFMTIS reliable enough to apply in the environment? **All the expert reviewers agreed that the SFMTIS addresses a real problem/need and that it is reliable enough to apply in the environment.** Expert reviewer 3 noted *"yes it is reliable, it can assist in enhancing sustainability in our schools and also the district"* and *"it also shows areas that need development"*. Expert 3's view is supported by expert reviewer 5 who stated *"yes (it addresses a real problem). It supports us and gives direction of continuity"*. Expert reviewer 7 elaborated that *"the concepts included in the framework are grounded in literature, and their application has been proven to be relevant in practice. The validity (reliability) of the framework is therefore implied"*. Expert reviewer 7 also explained that *"true validity would only be proven once it has been shown in a number of practical applications that sustainability has been influenced. To this end, clear indicators of sustainability would be required"*.

Financial sustainability was highlighted by expert reviewers 4 and 7. Expert reviewer 4 stated: *"Yes, it (SFMTIS) is needed for sustainability although there is a problem on its application due to financial problems"*. Expert reviewer 7 explained that: *"The loss of investment when interventions are not sustainable is significant. In*

addition, engaging communities in initiatives that fail could lead to fatigue and negativity with respect to development initiatives, thus preventing future access and potential positive impacts".

5.4 Ease of Use and Application

The questions relating to ease of use and application were: Would it be easy to use the SFMTIS? How can the SFMTIS be applied? and What effect(s) can application of the SFMTIS have? Affirmative responses were provided by expert reviewers 1, 2, 3, 4 and 5 to the question: Would it be easy to use the SFMTIS? Expert reviewer 1 stated: *"Following guidelines and applying relevant policies will ease the use of the SFMTIS".* Expert reviewer 2 expounded: "*It would be easy because all relevant stakeholders have been interviewed, also they contributed concrete evidence and inputs".* Expert reviewers 6 and 7 did not respond to the question regarding ease of use. In response to the question: How can the SFMTIS be applied? Expert reviewer 3 explained that: *"It would be used first at the school level, where the schools will be made aware that they need to sustain the project. The district and province, in supporting schools and also creating funding and providing workshops and technicians for the schools".* In response to the question: How can the SFMTIS be applied? Expert reviewer 6's stated: *"Develop it as a policy guideline when implementing new projects".* Expert 7 responded: *"Ideally, the framework should be applied at the outset of an ICT4D implementation (planning stage), with the purpose of highlighting the important aspects that could affect sustainability, creating awareness of key issues to manage, and influencing project planning. It could also be used as a tool for checking progress of the project towards sustainability at regular intervals during implementation and re-adjusting project implementation accordingly".*

5.5 What Effect can Application of the SFMTIS have?

Expert reviewers' responses to the question: What effect can application of the SFMTIS have? The responses are listed in Table 3.

Table 3: Expert reviewers' responses to the question: What effect(s) can application of the SFMTIS have?	
Expert reviewer 1	It can improve the quality of integration of technology in resource-constrained schools.
Expert reviewer 2	It can have a positive effect on institutions if all the features of the programme can be integrated.
Expert reviewer 3	This will assist teachers, principals and districts into knowing what their role is, and to be able to respond to the question: How do they sustain the project?
Expert reviewer 4	Yes. (1) Motivation to all stakeholders, (2) Socio-economic factors.
Expert reviewer 5	Commitment to the project by all stakeholders; informed communities on ICT.
Expert reviewer 6	-
Expert reviewer 7	It could raise awareness of key sustainability issues and influence the management and implementation of an initiative towards sustainability.

Expert reviewer 1 stated that the effect of application of the SFMTIS is that

"It can improve the quality of integration of technology in resource-constrained schools" and, expert reviewer 7 responded that

"It could raise awareness of key sustainability issues and influence the management and implementation of an initiative towards sustainability".

5.6 Possible Improvements

The questions posed to the expert reviewers in order to establish possible improvements to the SFMTIS framework presented to them were: What three features of the SFMTIS would you consider irrelevant? and What is missing in this framework?

What three Features of the SFMTIS would you Consider irrelevant?

Expert reviewers responded to the question: What three features of the SFMTIS would you consider irrelevant? Two of the expert reviewers, 3 and 4, considered all of the features of the SFMTIS to be relevant. Three of the reviewers, expert reviewers 1, 2 and 4, stated that the political dimension is irrelevant. There were two expert reviewers who considered culture to be irrelevant. Expert reviewer 5's view was that schools require the support of the department to provide finance for security and technical costs. Expert reviewer 7 suggested that two of the diagrams be integrated and improvement to another diagram by reducing the details presented.

What is Missing in this Framework?

Expert reviewers 1, 2 and 3, considered the SFMTIS to be comprehensive. Expert reviewer 1 noted that *"all the relevant stakeholders are involved, as for me this is a comprehensive framework. Nothing is missing"* and expert reviewer 2 commented that *"as far as my opinion is concerned it has meaning, there is nothing that is missing"*. Expert reviewer 3 stated that *"at the moment I do not see anything missing now"*.

Additions were suggested by expert reviewers 4 and 5. Expert reviewer 4 suggested inclusion of the directive approach and expert reviewer 6 stated: *"Asking sponsors from other companies to support the project e.g. Eskom, MTN, Vodacom, etc. financially to bridge gap not done by education and schools"*. This perspective is supported by expert reviewer 7's remark that: *"The overall framework could make provision for funders, implementers, and commercial entities. These are often key to the intervention, and are not part of the education system or the other stakeholders listed in diagram"*.

Expert reviewer 7 suggested integration of the framework: *"The four different representations of the framework could be integrated into a single picture (with links between the elements, if necessary), so as to position the different ways in which the framework is implemented relative to each other, and to make the role of each clear"*. In addition, expert reviewer 7 specified the need to emphasize the strategic aspect in the institutional dimension, and explained that: *"The Institutional dimension could include a strategy element (i.e., alignment between the strategic intent at micro, meso, and macro level). In addition, the strategic intent of the implementers and funders (who could reside outside of the education system) could also be considered"*.

6 The final SFMTIS

The intermediate SFMTIS was refined based on consideration of the expert reviews.

Expert reviewers' views applied to *intermediate SFMTIS* to develop the *final SFMTIS* shown in Figure 4:
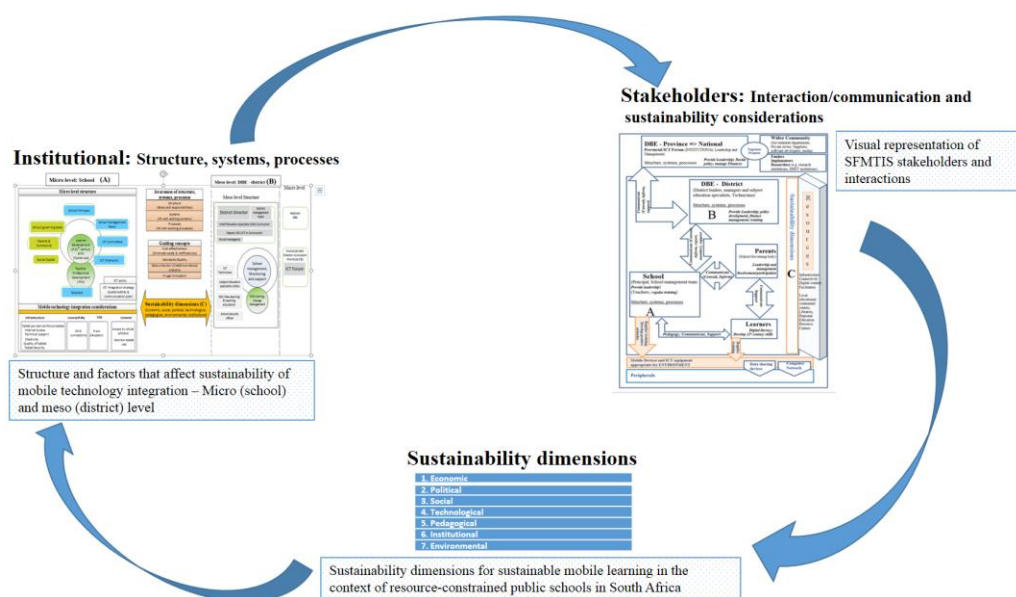
Figure 4: Final SFMTIS components (The details of the *final SFMTIS* components can be accessed at https://goo.gl/xATDEZ)

The following were incorporated into the *final SFMTIS* based on the feedback from expert reviewers:

- Two of the diagrams representing the structure at micro and meso levels were combined into one , and the funders and implementers were given more prominence in the representation of stakeholder interactions.

- The alignment of the strategies within different levels of the department, in the institutional dimension were highlighted, and the term *data sharing devices* was utilised in the SFMTIS visual representation diagram instead of *data projector* and *printer*.

Figure 4 shows the components of the final SFMTIS:

- Visual representation of the SFMTIS stakeholders and interactions.
- Structure and factors that affect sustainability of mobile technology integration - micro (school) and meso (district) levels.
- Sustainability dimensions for sustainable mobile learning in the context of resource-constrained public schools in South Africa.
- Sustainability dimensions - practical example: Spider web.
- Sustainability dimensions - practical example: Bar chart.

The final SFMTIS incorporated the expert reviewers' recommendations, perspectives of teachers and district officials (Phase 2), and was based on the initial review of extant literature on general sustainability frameworks, sustainability frameworks for ICT4D frameworks specific to resource-constrained environments and a framework for mobile technology integration into schools.

7   Conclusion

The evaluation phase in the development of the final SFMTIS is examined in this article. The research expounds on how the intermediate SFMTIS artifact was evaluated through expert reviews in the DSR process to develop the final SFMTIS. The study was undertaken in a resource-constrained environment, and the SFMTIS is based on contextualized research. The evaluation of the framework is based a requirement of the DSR methodology, and the research findings highlight the value of the expert reviews in refining the artifact. The utility of the SFMTIS framework was confirmed by the reviews provided by the expert reviewers. The purpose of evaluation of the SFMTIS was to establish if the artifact developed achieved its purpose and to what extent. Evaluation established highlighted aspects of the intermediate SFMTIS that could be improved. The final SFMTIS incorporated recommendations made by the expert reviewers. The importance of the sustainability dimensions for mobile technology integration, namely: economic, political, social, technological, pedagogical, environmental and institutional sustainability was confirmed by expert reviewers' evaluation, however the levels of importance considered varied. The research was also considered by the expert reviewers to address a real need for schools and the education system to sustain mobile technology integration. Insights that emanate from experts' reviews include the importance of the economic, technological and pedagogical dimensions, and institutional sustainability aspects, such as security. The relevance of the SFMTIS was demonstrated by expert reviewers' assessment, indicating the need for frameworks such as the SFMTIS, that can support the sustainability of mobile technology integration in resource-constrained environments. Collaboration with teachers and district officials, some of who have postgraduate degrees, is recommended for future research. The research demonstrates the value of the evaluation phase in the DSR process in the iterative development of the artifact and in providing critical assessment and feedback to aid in refining the framework.

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A Socio-Technical Framework for Mobile Information System Use to Collect Water Quality Information: A South African Developing Rural Municipality Case Study

Hendrik Pretorius[1] [0000-0003-2051-5290] and M.J. Hattingh[2] [0000-0003-1121-8892]

University of Pretoria, Private Bag X20, Hatfield, 0028
{henk.pretorius[1]✉, marie.hattingh[2]}@up.ac.za

Abstract. Rural municipalities in South Africa struggle to capture local water quality data accurate and complete with the current national "Blue Drop" Information System. This resulted in non-compliance with South African national water quality standards, legislation and requirements to safeguard and protect water assets in rural areas. In response to these problems, the South African government developed a Mobile-based Information System (MIS) for water quality monitoring in these rural and under-resourced municipalities.

This qualitative study applies social-technical theory to understand the role that a MIS can play in shaping water quality monitoring in rural and under-resourced municipalities in South Africa. The Nkangala rural municipality served as a pilot case study to conduct the research. Data was collected from 10 employees responsible for water quality monitoring at the Nkangala municipality, mainly through semi-structured interviews. Thematic analysis was applied to analyze the data.

The research proposes a socio-technical framework for MIS use to collect water quality information in rural and under-resourced municipalities in South Africa. In the context of this study, benefits of introducing the MIS included the capturing of real-time, accurate and complete water quality data for improved managerial decision-making, accountability, reporting and communication. On the downside, employees had to be trained how to use mobile devices responsibly. Suggestions were made on how to improve the usability of these mobile devices for the future.

Keywords: Water Quality Monitoring, Blue Drop System, ICT-D.

1   Introduction

Safe drinking water is vital for human health and wellbeing. To this end, the South African government aims to fulfil its objective of ensuring that every South African has uninterrupted access to quality water [1].

In 2004, the South African government established that more than 50% of municipalities in South Africa, responsible for water services and supply, are not monitoring the quality of water supplied to the various communities for consumption [2].

In response, an Electronic Water Quality Management System (EWQMS), to all municipalities was introduced to improve and regulate the supply of quality water in South Africa [3]. However, limitations with regard to the EWQMS was discovered. The system works re-active rather than pro-active. This means, water contamination is discovered only after being used. Two water contamination incidents in South confirmed the health risks this approach posed to communities [4].

The South African Government drafted a preventive risk management Drinking Water Quality Framework for all municipalities to ensure safe and quality water to all communities [5]. The "Blue Drop" certificate program was introduced, which included the "Blue Drop" Information System (IS) for the efficient, effective and transparent management of water quality.

However, since 2009, it has been reported that urban municipalities in South Africa have consistently been improving their water quality and management thereof, while rural and under-resourced municipalities are falling behind [6]. Furthermore, according to Champanis et al. [7], rural municipalities in South Africa are poorly managed with which contributes to the inadequate collection of water quality data (inaccurate and incomplete). This results in non-compliance with national water quality standards, legislation and water quality requirements [7,8]. The IS was also difficult to operate with limited and under-skilled municipal resources [7] that resulted in poor decision-making at rural municipality level effecting communities.

In response, a pilot MIS was developed for water quality monitoring to address the problems in the rural municipalities [7]. From a practical and theoretical perspective this study aims to propose a social-technical framework that explains how a MIS can shape water quality monitoring in rural municipalities (rural communities are more familiar with mobile technologies [9]), not done before.

2 Literature Survey

The literature is explorative in nature and therefore organized in relevant literature themes. This is common for research in new knowledge areas, where little or no theory exists [32]. The literature presents contextual background about the research study and water quality monitoring within South Africa. The literature section is concluded with an overview of social-technical theory that is used to explain how a MIS can shape water quality monitoring in rural communities and municipalities in South Africa, not done before (theoretical gap).

2.1 Water Quality Monitoring in the South African Context

Water quality is defined, as a measure of the water quality to determine if the water is fit to do which it is intended to do such as farming, drinking, industrial processing or swimming [9].

Three groups of factors are used together in the measurement of water quality, which are physical factors, chemical factors and biological factors. These factors are used to define a set of compulsory norms and standards to ensure quality water in a specific context [5]. In South Africa, these norms and standards act as guidelines and regulations to govern the water quality service function for safe and quality water.

For many years, most water services management bodies in South Africa have depended on expensive, time- and labour-intensive on-site water sampling, data collection and transport to land-based or shipboard laboratories to monitor and test the water quality [10]. Laboratory-based monitoring or testing of water quality requires large numbers of water samples to be collected, mainly depending on human resources [11]. Although results take a long time to become available, traditional laboratory-based monitoring is cost-effective in terms of equipment, portable and easy to use [9]. Unfortunately, the cost and time of collecting water sample data is high in laboratory-based monitoring. This potentially introduces human error and time delays. The result is a decreases in the quantity and quality of water data [12].

Over the years, design engineers have developed sensors and other instruments for real-time water quality monitoring in remote areas. This allows scientists to obtain, process and transfer an array of water quality data while still in the field, using sensor technologies, mobile computing, and wireless communications [13]. Processing of the data is typically done remotely by off-site laboratories

The benefit of this approach is real-time water quality monitoring, crucial for national and international health and safety. It provides real-time alert notifications of possible water contamination events, which may ensure effective and speedy interventions to high-risk areas [13].

In South Africa, water pollution started in the first half of the 19th century when towns and industries were developed and water waste accumulated in such areas [8]. Sewage disposal methods where developed in order to monitor and control the water quality. Still, according to EPA's watershed indicators, over 290 000 miles of rivers and streams do not meet the national water quality standards [8]. Only 16% of watershed areas was reported to have good quality water, while 36% was reported to have moderate water quality and 21% poor water quality [8]. The water quality of the remaining 27% could not be confirmed because of insufficient or incomplete water data. Added to that, one in 14 watersheds in all regions are exposed to a risk of water pollution from urban-to-rural runoff [14].

The South African Water Act of 1956 [15], applied the water rules and regulations from Europe to South Africa [16]. These rules and regulations were inappropriate, because European countries contain much more water than South Africa, regarded as a dry country [16]. The Act further did not recognise water as a basic human right and focussed on: "water use and the development of dams rather than on water protection, conservation and demand management."

This act was replaced by the National Water Act (NWA) of 26 August, which facilitates the management of water resources in South Africa [17]. The key purpose of the NWA is to ensure that water resources of South Africa are protected, used, developed, conserved, managed and controlled in a useful and comprehensive way [18]. The NWA are guided by the principles of sustainability, equity and efficiency [17]. Sustainability in this regards means supporting social and economic development in parallel with making sure that the environment is safe both now and for the future [19]. Equity refers to a situation where everyone has access to quality water and everyone has the benefit of using water [1]. Efficiency means water should be taken care of and used to the best possible social and economic advantage [1].

In other words, the NWA act aims to enforce fair and equal distribution of water [18, 19]. Everyone has the right to water as a basic human need, as long as the water is for activities such as drinking, preparing food and personal hygiene [17].

2.2   Mobile Information Systems

A Mobile Information System (MIS) is described as an information system that uses mobile end user terminals, such as mobile phones to access information resources and services wirelessly from any location anytime and anywhere [20]. This is probably the biggest benefit of introducing a MIS into an organization.

MISs further benefit organizations to enhance productivity, increase process and procedural agility, flexibility, effectiveness and efficiency for improved customer service. MISs provides accurate localized real-time information for decision-making through mobile device portability [9,21]. However, organizations should assess their MIS readiness and where these systems can benefit or make a difference in enterprise business processes. Adoption and implementation strategies should also accompany a MIS into an enterprise. Mobile devices still remain relatively small, which inhibits the quality characteristic of usability. Usability remains one of the main characteristics supporting the multi-dimensional concept of the quality of ISs [21].

## 2.3   The Nkangala Water Monitoring Mobile Information System

The Water Quality Reporter (WQR) was a mobile application developed by a Civil Engineering team iCOMMS at the University of Cape Town in South Africa. The application assists to carry out residual chlorine water testing and hydrogen sulphide tests for possible microbiological contamination in water destined for household use. The live report back system gives an immediate indication of non-compliance at water sample points.

The Mobile Information System consists out of a network of nodes, distributed in water areas. These nodes monitors and collects water quality data. Then, a mobile device that makes use of a GPRS network, transports data collected from the monitoring nodes to a remote monitoring center. The monitoring center analyses and processes the water quality data. An alarm is raised for emergencies like water contamination or sudden changes in water quality.

The mobile device also provides support for decision-making in prevention and remediation of water contamination. Although the Mobile Information System uses certain hardware (colorimeters, turbidity meters, PH meters, dissolved oxygen meters and conductivity meter) in the field for water monitoring testing, the solution provides a low cost, flexible disposition, low power consumption solution that has a minor influence on the natural environment [22].

2.4   Social-technical Theory

The social-technical perspective suggests that two interdependent subsystems – the social and technical subsystems - make up an organizational work system [23]. The social subsystem is concerned with people, e.g. their attitudes, skills, values, the relationships among people, authority structures and reward systems, while the technical subsystem is concerned with process, tasks and technology to transform inputs into the required outputs [24], as indicated in Fig. 1.
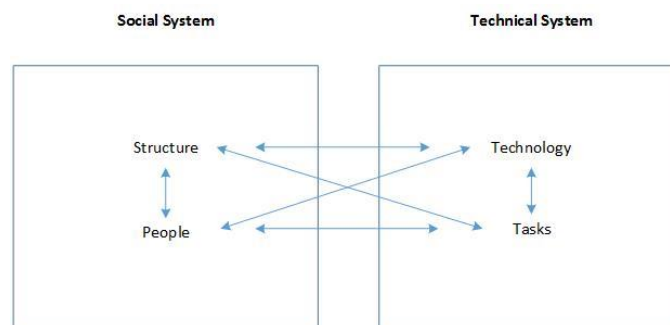
Fig. 1.   Socio-Technical Theory [23]

Social-technical theory implies that the technical and social systems cannot be viewed separately and that the interaction between these two subsystems determine the effectiveness of an organizational work system. These two subsystems must be jointly optimized for the most effective work solution for the organization [23]. In socio-technical theory computer-related technology is neutral. Typically the social system causes computer-based ISs to fail [24]. The theory considers the impact of each subsystem on the other for an organization's work system and that the requirements of these two subsystems must be met simultaneously to be effective [23].

The theory is widely accepted in socio-technical IS studies [25, 26, 27] and can be extended and applied to this study to analyze, understand and transform (how the social and technical system can jointly be optimized) the socio-technical work environment where a MIS is used in a rural municipality of South African to shape water quality monitoring and testing, not done before. A social-technical framework is later proposed to explain how the use of a MIS will shape the water quality monitoring in rural municipalities in South Africa, which also serves as the theoretical contribution for this study.

3   Research Methodology

In this research study, we adopted an interpretive research paradigm approach using qualitative methods. The research involves an in-depth, exploratory case study of a rural municipality in the Nkangala District in Mpumalanga, South Africa. The Nkangala municipality was one of four rural pilot municipalities that was selected by the South African government to implement a mobile-based information system for improving the water quality monitoring proses in rural areas in South Africa. The case study provided the researcher with an insightful understanding of how a MIS is used for improving water quality monitoring in rural areas by municipalities in South Africa.

Data was collected through semi-structured interviews and observations between February 2017 and October 2017 at the Nkangala municipality. The data was collected from the municipal manager, three administrative personnel, four water supply testers, one water service employee and one water service manager. In other words, managerial, administrative and operational employees from the municipality. The interview questions were different for managerial employees and operational employees.

The interviewees were employed at the municipality between 5 and 16 years during the time of the data collection. The interviewees are from the local rural area where the municipality is located. In other words, the interviewees had the same social backgrounds, spoke the same language, but differed in age and gender. To protect the privacy of participants, personal information, such as name, age and identity numbers were withhold.

During the analysis, data was systematically coded into themes and categories (thematic analysis) as they emerged during the analysis stage. Braun and Clark's [28] guidelines to conduct thematic analysis were used to identify themes and patterns in the data.

4   Analysis and Discussion[1]

The purpose of this this study was to evaluate the feasibility of a MIS that had been implemented in the Nkangala municipality with the aim of improving water quality monitoring. The main objective of this study was therefore to evaluate whether the implementation of this information system had improved the efficiency and effectiveness of the water quality monitoring process in Nkangala municipality. The discussion of the results will be structured according to the socio-technical elements, as listed in Table 1.

Table 4. Water quality management: Socio-technical perspective

Social Subsystem	Technical Subsystem
People (Section 4.1) • Types of water quality workers • Knowledge management	Technology (Section 4.3) • Support local water quality monitoring needs • Usability of WQR system • Operational issues with WQR system • Informed reporting from the WQR system • Increased management communication and awareness
Structure (Section 4.2) • Challenges with management authority • Improvement of employee accountability	Tasks (Section 4.4.) • Tasks performed by water quality workers for example water quality data collectors • Lack of National standards an understanding of regulations

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[1] Acknowledge the use of data from: Raphulu, T.G. (2018). *Using cell-phone based information Systems for quality water monitoring: A case study of Nkangala District Municipality.* Master' Dissertation. University of Pretoria.

4.1 People

In terms of the socio-technical theory, people referred to the employees of an organization (the Nkangala Municipality), their knowledge skills, attitude and values [24]. Managerial, administrative and operational employees were involved with the WQR system were interviewed which revealed that a variety of employees are using the system for different purposes. The employees were concerned about knowledge retention due to high staff turnover. Each of these aspects (employee types and knowledge management) are discussed below.

Types of Water Quality Employees. In Champanis [7] it was described that in order to complete the water quality monitoring tasks, a number of water quality employees are involved. Subsequent to performing water quality tests, the water quality data collector records the readings in the WQR application on his telephone.

The manager then receives a message from the system and performs basic verification and data integrity checking before storing the incoming data in the database and sending a confirmation SMS to the tester. In case of a result outside of acceptable operational parameters, an SMS alert is received by both the operator and the manager.

The different roles performed by the water quality employees require for them to engage with WQR system at different stages of the process. The tasks described in section 5.4 need to be completed using the technology described in section 5.3 within the constraints of the organizational structure, described in section 5.2.

Knowledge Management. The results from the interviews indicated a need for knowledge management in order to ensure the success of the water quality monitoring program. A water test supplier for example indicated: *"Have and balance age differences in key positions so that proper knowledge transfer can take place."* This was reinforced by an employee administrator that indicated that knowledge transfer should be *"incentivized"*.

Knowledge management ensures that useful organizational information are transferred to younger generations to stay inside the organization [29]. Managing workers to satisfy their own and expert knowledge objectives is pivotal for the fulfilment of objectives in the organization. Human resources programs (such as career development programs) that promote the growth of employees are essential to retain knowledge in the organization [30].

One suggestion to accomplish the transfer of knowledge is through teamwork which was supported by participants 3 and 8. Participant 8 indicated that: *"Teamwork should be encouraged across the board"*

Working in groups not only allows work to be finished considerably faster and more effectively, but it also promotes the sharing of information and a shared vision. Through cooperation in a group, each individual gets the opportunity to learn and build up individual and expert vocations.

4.2 Structure

In terms of the socio-technical theory, structure refers to the broader organization issues such as reward systems and authority structures. The interview data revealed poor decision making (using the "Blue Drop" IS) at local municipality level, because of incomplete water quality data. This resulted in the development of the WQR system (the MIS), which improved employee accountability. Each of these elements will be discussed below.

Challenges with Management Authority. From the interviews it was evident that the "Blue drop" IS has resulted in the Water Service Managers not being able to make decisions at local municipality level because of incomplete, inaccurate or incorrect data, as confirmed by the Water Service Manager: *"... power and decision-making about the process of monitoring quality water should be done at a municipal level, whereas the Blue Drop System that was implemented for monitoring water quality was done nationally."* The inability of having the necessary local authority to make decision impacted the ability to meet the local needs (as will be discussed in section 5.3), as indicated: *"Therefore local needs are not catered in the system which, always, resulted in our data not compatible with the system and we always get the lower score of quality water."*

Improvement of Employee Accountability. The WQR system allowed Management to hold employees accountable for the samples they connected. The water quality manager explained it as follows:

"The system was designed in such a way that it allows tracking of progress or communication of the latest statistics. For example, the Blue Drop System communicates to the public the status of water quality in each municipality of South Africa; however, it does not communicate who is responsible and who the various government structures at local level are that should be held accountable."

"Using the mobile-based information system, problems faced at water supply sites were identified sooner and the experience of accountability increased, not only for the government employees but also for the communities involved."

The nature of the WQR system allows managers to remotely manage employee accountability as reports are generated following the completion of a task.

4.3 Technology

In terms of socio-technical theory, technology refers to "devices, tools and techniques needed to transform inputs into outputs" [24]. From the data it was evident that WQR system was successful in meeting local needs. It was found to very useful and allowed for informed reporting and increased communication. However, uncovered operational issues associated with the use of technology was discovered, as will be discussed next.

Support for Local Water Quality Monitoring Needs. A challenge experienced by the "Blue Drop" IS was that the collective IS data collected by all municipalities were not individualized to local municipalities but rather generalized and nationalized. This conclusion is aligned with the study done by [7], who mentions that centralization of government systems disregards local differences and overlooks local needs. The WQR system implemented addressed the shortcomings of the "Blue Drop" IS, as illustrated by these quotes:

"The design of the mobile information system is made in such a way that it caters for local data and information needs."

"The standard and regulations for quality water is catered based on the needs for a particular municipality."

Therefore, the WQR system provides a unique identity to the Nkangala District Municipality, as it is tailored to suit it or cater for its unique data and information needs. The system enables the municipality to get accurate results for its water quality monitoring, as it provides the base for accurate data to be collected and captured.

Usability of WQR System. In Champanis [7] it was indicated that the functionality of the MIS provides quite a number of benefits such as less redundancy, high availability, centralization of security, as well as a reasonable lead time for water quality monitoring data collection. This was supported by interview data that indicated the following:

"The mobile-based information system is experienced as easy-to-use/user-friendly, due to replicating already existing workflows".

"It is easy to use in such ways that even a person that don't have professional knowledge of computer literacy can adopt and be able to use it."

The MIS is user-friendly, since it replicates already existing workflows. However, the data has indicated that displaying lengthy sample point names on the narrow screen is not ideal. The screen for the mobile device is so narrow, which makes it difficult to read and capture information.

Informed Reporting from WQR System. The WQR system resulted in the increase in regular communication and an increase in awareness of the water quality at the various field sites. Managers also reported that the amount of travel to remote sites was reduced since they were able to assess sites from the office, as indicated below:

"Increase in awareness and appreciation for the need to collect information for monitoring purposes."

"We, as managers, felt that our confidence in water quality had increased and the system was experienced as providing relevant information for decision-making."

"We, as managers, felt that we had a better understanding of the movements of the borehole operators and their needs."

"In some of the sites, the system became an HR management tool and the tool had increased our workload due to being more aware of the challenges in one of the outlying villages."

The quotes above illustrates how the technology, supported the people in the completion of their tasks.

Increased Management Communication and Awareness. The information system enables the flow of data/information between the Nkangala municipality and the "Blue Drop" IS System for meeting the water quality standards and regulations prescribed by the national government. Data that are collected and captured with

accuracy, enables the decision-making process to be flexible and accurate, therefore management can manage with better understanding of the challenges in the local areas

The WQR system has benefited the municipality in that reporting of water quality standards has increased, accountability has improved and the administrative processes of the municipality have been automated.

Operational Issues with WQR System. A number of operational issues hindered the execution of the water quality monitoring tasks. These challenges include:

- Users were able to delete the application from the phone's storage; this happened regularly despite warnings against it. The Water Quality Tester explained how the application was regularly deleted from the phone devices: "*Our assumption is that this happens because when you are browsing Nokia applications and you press the Menu key, the first option in the menu is Deleting, and this coupled with non-English speakers' results in it being pressed more than it should.*"
- Users would fill up the phone with music and video downloads, sometimes to such an extent that the water quality monitoring application could not be reinstalled without removing some of these applications filling up the phone storage. The water quality testers justified this by saying that: "*when they are at the field, they entertain themselves with music when conducting the sample.*"
- Application reinstallation presented problems. When there are new versions of the application, these new versions can be sent via SMS or be downloaded using the phone's web browser. The manager said: "*Both options are complicated and unfamiliar actions to technicians who have just been taught the basics of the phone. And also the airtime to download is expensive for the technician to use the phone's web browser.*"
- Using the airtime on the phone device to do the day-to-day administration on the phone proved to be challenging, as indicated by the Municipal Manager: "*The use of airtime is an administrative challenge in all of the settings. ... A field technician is provided with airtime to submit data, however, sometimes this airtime is used up by calls, downloads, and so on. It is important to discuss this aspect of a mobile implementation with the relevant stakeholders at the beginning of the project.*"

4.4   Tasks

In terms of the socio-technical theory, tasks refer to the activities that needed to be completed by the people but is supported by the technology. The data has revealed how the tasks performed by water quality workers were supported by technology in terms of workflow. Furthermore, it has been revealed that employees do not always follow the national regulations regarding water quality monitoring.

Tasks Performed by Water Quality Workers. The data indicated that "*the use of the information system requires no paper work administration, as everything is done on the mobile system then uploaded to the national database*". "*It does not require any other installed equipment to be able to operate.*" The issue with the Nkangala District Municipality is that the employee used to go to the field to collect data by writing the values on a piece of paper in a notebook. Later these values were entered in a worksheet. Subsequently, the values were manually entered into the database system that was sent to the national Blue Drop System. This process was slow and prone to human error. The use of a MIS speed-up the entire process. Monitoring is a real-time process that gives managers and other stakeholders' immediate access to the information for decision-making. In the interview, site managers reported that the amount of travel to remote sites was reduced.

Field workers can now also access the central municipal database. With the integrated environment, being adjusted to the device being used, field workers are allowed to bring the gadget with them that best suits their requirements on a particular work day.

Lack of Understanding National Standards and Regulations. Monitoring water quality for human use is very important for the wellbeing of people in communities. The "Blue Drop" IS was implemented nationally by the government of South Africa with the aim of enforcing standards and regulations for drinking water quality provided to citizens. While investigating the use of this system in Nkangala District Municipality, the researcher found that the reported information for monitoring water quality was inadequate [31]. Employees revealed their failure to understand the standards and regulations for water quality monitoring, which forms part of the challenges they face with the "Blue Drop" IS, as indicated by one of the interviewees: "*It seems as if we could not understand the standard and regulations that were required in order to acquire the green light certificate for quality water*".

This problem is escalating at Nkangala municipality, which is unable to provide employees with education and training to understand national standards and regulations for water quality monitoring. User training is recommended.

4.5   A Social-technical Framework for MIS Use in Rural Municipalities in South Africa.

Fig. 2, illustrates the socio-technical framework for MIS use in rural municipalities in South Africa. The framework illustrates the reciprocal relationship between the types of water quality workers, the structure, the technology and tasks. The types of water quality workers, contributing to knowledge management in the DWS is being influenced by the challenges associated with employee hierarchy structure. These challenges in turn influences the extent knowledge management can take place within the DWS and the ability to use the technology. The different types of water quality workers' ability to complete their tasks is mediated by the type, and their competency of using the technology at hand.
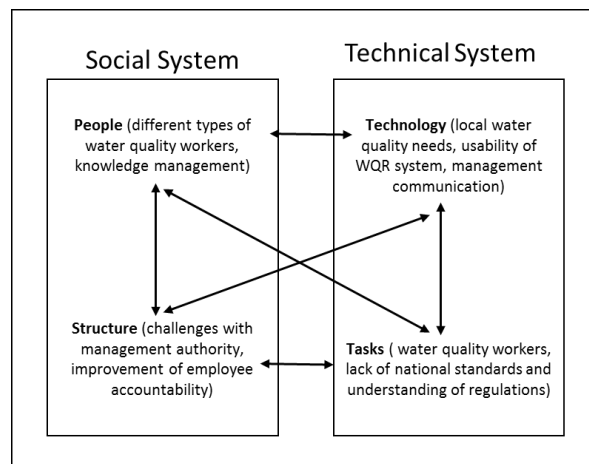
Fig. 2. MIS use in rural municipalities in SA socio-technical framework

5   Further Recommendations for a Socio-Technical Approach to Water Quality Management

The socio-technical theory allows for the explanation of interactions between the socio and technical subsystems. From the discussion with the interviewees, the following recommendations can be made to improve the feasibility of the WQR system.

5.1   Recommendation 1: User Training

In order to improve water service delivery outcomes, employees need to be properly trained in all aspects of water quality monitoring. Participant 5, for example called for employees to be trained in accordance with national standards and regulations (to correct the challenges identified in section 5.4):

"Training employees must be focused on the national's standard and regulations regarding what quality in our country", he furthermore stated that: *"Employees' training must be formalized and made mandatory"*

The call for employee training was supported by participants 1,6,7,8 and 9. Trained employees will allow for "succession planning" (Participant 8) and "knowledge management" (Participant 1).

5.2   Recommendation 2: Future Development Suggestions.

Participants of the study suggested a number of future development functionalities. Table 2 below summarizes these suggestions.

Table 5. Future development suggestions

Functionality	Quote
Location services	*"it will be a good functionality to have if the system can capture the physical location for the field worker automatically and store the coordinates"*
Videos and pictures of sites (to identify site)	*"We have not been showing videos and pictures of the site in the information system, but we realize that this functionality will be of importance to have."*
Videos and pictures of contaminated sites (as proof)	*"The field worker can take picture and videos when monitoring water in order to have physical visibility of the contaminated water"*
Share information with other municipalities in district	*"Nkangala district has many municipalities; this information system should be able to share information with other municipalities within the Nkangala district."*
Integrate test devices	*"Integrating between different devices that runs different system functionalities for the same sample collected. For example, we use three devices to test the same sample in order to get three different results, it will be ideal if this mobile information system can have those three functionality embedded/integrated on one system."*

Mobile phones offer the promise of linking data from one entity to another. The social and technical subsystems are integrated on system and organization-information levels to perform tasks in the interest of the region.

6   Conclusion

As theoretical contribution, this research study propose a socio-technical framework (based on social technical theory) for understanding an explaining how the Nkangala municipality can use a MIS for shaping water quality monitoring in rural municipalities in South Africa. This framework explains the interrelationships between the water quality monitoring employees (people), executing their water quality monitoring tasks/processes (tasks), supported by the WQR system (technology) within the confines of the national water monitoring regulations and governance structures (structure).

On the practical side, the study revealed that the MIS assisted with the retaining of knowledge and knowledge processes. It has further improved employee accountability and managerial decision making due to increased information, reporting and communication. These advantages were as a result of real-time data collection and analysis (data did not get lost after collection) which improved the overall quality assurance of the water. Although the system was found to be user friendly, the employees did indicate areas where the user interface can be improved, because the user interface was very small. The biggest challenge for the success of the MIS was addressing the operational issues (section 5.3) that was experienced. These issues can be circumvented through proper user training.

Finally, the employees offered a number of suggestions for future development that can improve future MIS use for water quality testing.

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Implementing E-government Financial Systems in a Developing Country: An Institutional Perspective

Hubeidatu Nuhu[1][0000-0002-0429-1170] , John Effah[2] and Jean-Paul Van Belle[3][0000-0002-9140-0143][✉]

[1,3] University of Cape Town, South Africa
[2] University of Ghana, Ghana
[1]NuHubei@gmail.com
[2]johneffahk@gmail.com
[3]Jean-Paul.VanBelle@uct.ac.za

Abstract. The aim of this research is to understand institutional effects on e-government financial systems implementation from a developing country perspective. Existing studies on e-government financial systems have focused more on the challenges, failures and specific success guidelines. However, less is known about institutional effects on the implementation of such systems. To address this research gap, this study focuses on the implementation of Ghana's integrated financial management systems and related institutional effects. The research question for the study, therefore, concerns how the institutional environment in a developing country shapes e-government financial systems implementation. To address the research question, the study adopts an interpretive perspective, qualitative and case study approach as a methodology and the new institutional theory as the analytical lens. The findings reveal how inadequate legal frameworks and unfavorable public sector culture negatively impact e-government financial system implementation.

Keywords: E-government, e-government financial systems, integrated financial management system, interpretive case study, institutional theory, Ghana.

1   Introduction

The influx of the internet and its related technologies has made its adoption into various organizations, both public and private sectors, inevitable. As a form of digital inclusion e-government involves the use of ICTs to e-transform governments and their agencies [1]. E-government promotes rapid participatory communication between government, citizens, businesses and other government agencies. Based on the participatory groups, e-government can be categorized into four broad types as government to citizen (G2C), government to business (G2B), government to employees (G2E), and government to Government (G2G). Using this classification, an e-government financial system is seen as a form of G2G, involving the use of ICTs to manage and account for public funds.

E-government implementation in the public institutions triggers various changes that are e-enabled. It promotes the transitioning from effective and inefficient traditional government services to their more effective and efficient forms via e-upgrade and e-empowerment [2]. Such transitions have led to various forms of transformations in the in core government processes within and between various departments and agencies [3]. The introduction of Integrated Financial Information Management Information System (IFMIS) is a G2G e-government strategy focused on e-transforming government financial information through systems. An increasing number of governments in developing countries have adopted IFMIS to address the problem of mismanaging public sector funds [4,5]. To this effect, countries such as Sri Lanka [6,7]; Romania [8]; South Africa [9]; Nigeria [10] and Zambia [5] have embraced and attempted to implement IFMIS. Thus far, the focus of extant literature has been on challenges, failures and specific success guidelines. However, issues related to the institutional environment are yet to receive research attention. In line with this research gap, the focus of this study is to establish the relevance of the institutional environment and its effects on IFMIS implementation from the perspective of a developing country.

Theories so far used in understanding IFMIS has been limited to contingency theory [11], actor network theory [12,13], the technology acceptance model [14,15] and relational expectancy theory [16]; these neglect the institutional environment and its inevitable implications on the implementation of the phenomenon. Although the pillar view of the institutional theory has been used by some IFMIS researchers, the focus has been on the effects of single pillars. For instance [17] used the regulatory pillar and accessed its influence on IFMIS and noted its relevance in the implementation process and the need for conceptualization. Research has highlighted the need to empirically examine the institutional environment in public sectors due to the existing irregularity between intended and unintended consequences of IS as a result of differences in culture and norms [18]. The relevance of

adopting the institutional theory lies in its ability to explain interactions and social actions within a context, filled with technical and non-technical artifacts [19]. It has also been argued that organizational structure is not only constituted of technical resources but also myths and laws [20].

This study is thus aimed at seeking an in-depth understanding of IFMIS implementation through the use of interpretive case study as a methodology and the new institutional theory as the theoretical lens. In doing this, the study seeks to unearth the regulatory (national\ international), normative and the cultural factors that influenced the implementation of the IFMIS in Ghana. [21] noted the need for contextualizing e-government research due to the variations in culture.

The rest of the paper starts with a literature review on IFMIS implementation, followed by the theoretical foundation of the study and research methodology, and then the case study description. We then present our findings and conclude the paper by stating our contribution and recommendations for future research.

2   E-government Financial Systems in Developing Countries

E-government financial systems are the use of integrated systems to capture, process real time online enquiry and update financial information [22]. The concept also involves the use of computerized systems including software programs and distributed processes in a networked environment. The most commonly adopted government financial information systems are known in the literature as Integrated Financial Management Information Systems (IFMIS). The system is strategically aimed at transforming the financial sector of governments with the aid of ICT. IFMIS is, therefore, a computerized program geared at transforming government finances, control and allocation of financial resources. Within the context of this study, the government customized the name to Ghana Integrated Financial Management Information Systems (GIFMIS).

IFMIS is a public sector organization reform software tool, aimed at transforming government financial data and promote transparency and accountability [9]. The software has been implemented in Sri Lanka, South Africa, Kenya, Nigeria and Ghana. In Sri Lanka, for instance, the first attempt to implement the software failed due to lack of management commitment and ownership. Lessons from the first failure informed the success of the second attempt which recognized the importance of various internal stakeholders through commitment and participation [6,7]. This was supported by a steering committee and a secretariat to oversee the implementation process. In South Africa, [9], outlined various guidelines that can aid in successful implementation, which includes internal stakeholder involvement, forming a project management team and commitment. The implementation process in South Africa was noted to have neglected the guidelines presented and hence the failure of the software.

3   Theoretical Foundations

The new institutional theory based on the pillar point of view consists of the regulative, normative and cultural-cognitive pillars. The regulatory pillar represents laws and sanctions and hence demands compliance [23]. These laws define written down acceptable and non-acceptable behavior and practices. The normative pillar is the guidelines used to establish behavioral actions by an organization. In addition, the cultural pillar addresses behaviors or set of practices that have been sustained over time. Table 1 presents the three institutional pillars and their attributes.

Table 6. The three pillars of the New Institutional Theory [19,23]

Theory Element	Regulative	Normative	Cultural cognitive
Basis of compliance	Expedience	Social obligation	Taken for granted
Mechanisms	Coercive	Normative	Mimetic
Logic	Instrumentality	Appropriateness	Orthodoxy
Indicators	Rules, laws, sanctions	Certification, accreditation	Prevalence, isomorphism
Basis of legitimacy	Legally, sanctioned	Morally governed	Culturally supported, conceptually correct

The regulatory pillar relates to legal frameworks that drive social action detailed in sanctions and rules or laws. This is backed by regulatory professionals who with support from the state enforce obedience [23]. These laws define written-down acceptable and non-acceptable behavior and practices. Organizational rules serve as a means of control which guides individual behavior [24,25]. In this study, the regulatory pillar consists of both national and international laws that affected the implementation of GIFMIS and violations attract sanctions.

The normative pillar is the guidelines used to establish behavioral actions by an organization. Though the normative pillar outlines user behavior, it does not attract sanctions like the regulatory pillar. Violation of a normative belief attracts social effects such as gossip. Norms are, therefore, control systems in organizations based on shared and understood values [26]. Norms thus, influence employee interpretation of events and guide attitudes and behavior in an organization. Norms have mimicking effects in specific organizations. Public sectors, for instance, are likely to mimic the normative standards of other public institutions [27,28]. Norms in this study are both the written and non-written national and international standards that demand compliance but do not attract sanctions in case of violation.

The culture-cognitive pillar, on the other hand, constitutes meaningfully-understood shared structures in organizations [23]. They are behaviors that have been passed on from one generation another. They are not necessarily written down but are accepted by a specific group of people. Evidence of cultural variations between governments pertaining to systems acceptance is influenced through communication [29]. In this study, the cultural-cognitive pillar refers to the traditions that affected the implementation of GIFMIS while regulatory pillar refers to both national and international laws influenced the implementation. The normative pillar refers to documented procedures and standards of behavior.

4   Methodology

This study is based on qualitative, interpretive case study methodology. The ontological stance of interpretive research assumes that reality is subjective and is socially constructed between the researcher and the participants; moreover, the epistemological stance is that knowledge is also subjective [30,31]. IS researchers who use the interpretive paradigm focus on understanding the context and how information systems impact and are impacted within a particular context [32]. Qualitative research also emphasizes the subjectivity and multiplicity of realities from the perspective of study participants.

This study was therefore designed to understand an information systems phenomenon within a particular context. Based on the interpretive paradigm, this study seeks to understand the process of GIFMIS implementation in the public sector of Ghana. A case study is a form of qualitative research method that seeks in-depth understanding into a phenomenon within its contextual environment. A qualitative, interpretive case study in IS, therefore, involves the examination an IS phenomenon in its real-world setting [33]. The qualitative interpretive case study was chosen because the researchers consider it useful for gaining an in-depth understanding of the research phenomenon within its institutional context. Qualitative interpretive research allows investigation of a phenomenon set within a real-life contest with existing boundaries between them are not clearly stated [34].

Various sources were used for data collection, namely- semi-structured face to face interviews, observations, and documents (GIFMIS manuals, pamphlets and minutes of meetings). The sampling method was purposive as the study aimed at seeking understanding from the perspective of workers of CAGD and the GIFMIS secretariat. First, informal interviews were conducted with some participants to gain background knowledge about the implemented system. This was followed by formal semi-structured interviews based on interview guidelines related to the institutional pillars. One the average, each interview session lasted for one hour. The interviews were then transcribed. There were peculiar situations where interviewees did not want to be recorded, so notes were taken. 15 users from CAGD and ten managers from CAGD and the GIFMIS secretariat were interviewed.

Participants at the management level were asked questions on the implementation process in relation to, reasons and purpose, expectations, laws, culture and norms and their effects before and after the implementation. The users' questions centered on existing laws, normative standards and cultural effects on the new system. Questions on the regulatory pillar were targeted at unearthing the relevance of both national and international laws and their effects on the implementation. Questions on the normative pillar concerned international standards (normative) such as phased implementation and formulation of teams. Although, these are not generally regarded as coercive in accordance with the institutional theory, with respect to GIFMIS implementation they were coercive as they forced the implementation process into three phases. In addition, questions on cultural-cognitive factors were based on traditions that influenced the implementation of the system. There was, however, a challenge when the researchers wanted to know the various systems that had been used at the CAGD and the reasons for failure. Some of the participants were reluctant to respond to it, so we had to resort to using online documents.

With inference to the research question, on the institutional pillars that affected the implementation of GIFMIS in a developing country, we analyzed the data concerning the regulatory, normative and cultural-cognitive pillars as a sensitizing framework for institutional analysis and [33]. We first analyzed the data individually based on the emerging themes and met virtually to either merge or separate these themes in a simultaneous and iterative manner. This necessitated the revisiting of the field for additional explanations based on the emerging themes concerning the pillar view of the institutional theory until a saturation point was reached.

5 Case Description

5.1 Case Background

Ghana is a developing country in Africa with an estimated of 28 million. The country practices a multi-party and constitutional democracy as far back as 1992. Currently, the country has an elected president with 272 parliamentarians and an independent judicial system. The Controller and Accountant General's (CAGD) is the agency responsible for managing the public accounting system. CAGD was established in 1885 as the 'Treasury' however the name was changed to CAGD. As a public financial agency, CAGD is backed by the following legislation: the Civil Service Act (1960), the Financial Administration Act (2002) and the Financial Administration Regulation (FAR) (2004).

CAGD is responsible for providing financial management services to the Government and its citizens. Other responsibilities of the agency are receiving and securing public funds, making government payments including wages, salaries and allowances of public sector workers. The agency is also responsible for processing and payment of pension gratuity for retired civil servants, preparing government financial statements and promoting the development of efficient and effective accounting information systems in the public sector. As noted by a management staff member: *"the amount of data the agency captures and processes every day, has brought about an interdependent relationship between the agency and information systems. This interdependency is geared towards ensuring transparency, efficiency and effectiveness of public financial information."*

CAGD's operation involves dissemination of data and information within and between the various departments either through paper documents or online platforms. To ensure the safety of online data, various security measures were implemented by the agency.

5.2 Retrospective View of Information Systems at CAGD

The above-noted responsibilities of the agency led to the parallel implementation of various financial information systems from the late 1990's, aimed at enhancing transparency, accountability and corruption control. With the aid of funding from the International Development Association, the Department of International Development, the Canadian International Development Agency and the European Union the first the Government of Ghana (GoG) has implemented the integrated information systems at the CAGD. The Public Financial Management Reform Programme (PUFMARP) was implemented from 1999-2008, to enhance monetary discipline and micro stability. Moreover, to ensure transparency and accountability in public financial management. To achieve these goals the Medium Term Expenditure Framework (MTEF) was implemented as an add-on to the PUFMARP. The PUFMARP contained modules such as budget preparation, account and reporting, procurement, revenue management, aid and debt management and payroll. The PUFMARP, however, could not adequately aid in effective budget preparation. Other weaknesses of this system are related to its inability to automatically audit and account for expenditure; data could not be processed in real time and inadequate regulatory framework.

The integrated nature of PUFMARP coupled with challenges such as weak budget formulation and preparation, inadequate regulatory framework and inadequate accounts and auditing led to the introduction or the upgrading of the system into an integrated platform. Thus Public Expenditure Management System (BPEMS) was institutionalized in 1997. BPEMS was supposed to be integrated with other IS to enable easy processing of financial information across the departments of the CAGD. The modules in this system included aid and debt, revenue and cash management, audit and control, and human resource. The new integrated system was expected to aid in the transfer of financial data between the central bank, tax payment, procurement and audit with CAGD. The BPEMS was also challenged with inadequate power supply, lack of user capacity and commitment, lack of management support and lack of end-user commitment and ownership. As noted by some payroll and budget staff members: *"the new system was inadequate in its capacity to process financial data for effective decision making based on the known chart of accounts. There were a lot of irregularities in logistics such as budget preparation, payroll validation and voucher support."*

Consequently, from 2006 to 2009, the Short Term and Medium Action Plan (S/MTAP) was introduced to curb the weakness of the BPEMS. Thus an integrated payroll and financial database were introduced. Under

the S/MTAP program, inherent challenges such as unaccounted budget, revenue allocation irregularities, and external and internal audit challenges were to be addressed. This program also failed due to weak (outdated) legal frameworks, problematic integration and weak budgeting process. Other challenges included lack of oversight account monitoring and end-user unwillingness to use the modules. Thus the Ghana Integrated Financial Information System was introduced.

5.3   Ghana Integrated Financial Information System (GIFMIS)

GIFMIS is a packaged stand-alone generic solution for public sectors; it operates on the Oracle relational database management system, which was launched in 2009. The software was built on the Oracle e-business financial suit version R 12.1.3. The GIFMIS secretariat was launched in 2010 to control the implementation process. The software was supported by both national and international laws, Sarbanes Oxley Act of 2002 and SOX (PACAOB, 2004) and Financial Administration (FAR) Act, LI 2003, Act 654, FAR 306 of LI 1802, FAR 51 LI 1802 and FAR 298.

GIFMIS was implemented to address the challenges posed by the financial sector and the inability of the previous software's to respond to them. Expectations of the software were geared towards improving public finances through the effective formulation of budget and revenue mobilization, strengthen internal and external audit. A management staff noted: "*GIFMIS is expected to help curb the menace of ghost names in the payroll, thereby reducing corruption and promoting transparency and accountability in financial information. Currently, no ministry, department or agency can make procurements outside the system. Money allocated by the ministry of finance to agencies will only be released through the system to the controller and accountant general's department.*"

The software has both financial and non-financial modules. Budget preparation and allocation, payroll and revenue management, account payable and receivable and cash management constituted the financial modules while the non-financial modules included human resource, data warehouse and workflow management. The implementing of the software was also accompanied by both technical and non-technical requirements as summarized in Table 2.

Table 2. GIFMIS technical and non-technical requirements

Technical Requirements	Non-technical Requirements	Other requirements
Personal/portable computers	Availability of project team	End-user training
Hardware infrastructure	Management commitment	Adequate legal framework
Software	Institutional and human capacity	Phased implementation approach
Multi-processor web servers	Centralized treasury	
Local area network (LAN)	Power supply	
Wireless area network	Political support	
Systems security infrastructure		
Shared technological tools and language		

6   System Implementation Phases

GIFMIS was implemented in three different phases.

6.1   Phase One: Preliminaries

This phase constituted the preliminary stage of the implementation. It centered on technical training via workshops by the consultants to build the internal capacity of the agency. The training took the form of software demonstrations and how to effectively implement the suit. The trainees were made up of fifteen members internal staff who were knowledgeable in Oracle. They were trained in workflows, network and various interfaces on the suite. Aside from the fifteen member committee members, internal IT staff members were trained on the various

security features of the software. This was aimed at equipping them with adequate knowledge and skill on software vulnerabilities and how to control and prevent them.

After the training, the pilot implementation of the software was initiated. The Hyperion was selected as the required platform for the budget and cash management module. The Hyperion was a standalone e-budget application. However, since the Hyperion was not part of the original suite, it was integrated with it to enable easy budget preparation and cash management. The integration of the Hyperion enabled the transfer of budget and cash management data from legacy systems unto the new platform. The Hyperion was expected to facilitate an effective and efficient budget and cash management system. By consolidating public spending and accurate allocation of resources.

However, this phase was challenged by delays and inconsistent data migration due to lack of information sharing culture among the various departments and the unintegrated nature of the systems at the agency. Another challenge in this phase was the incompatibility of the fixed asset register and the payroll module; this, therefore, necessitated the incorporation of aspects of the BPEMS on the Hyperion. The integration also raised challenges such as unavailability of baseline data for testing; the insufficient available data was either in manual form or scattered across the various departments of the agency. Other challenges included inadequate ICT infrastructure, network connectivity and persistent power outages. These challenges informed specific decisions to be taken during the second phase since the integrated modules could not be used.

Although this stage faced significant challenges, end-users were trained in order to meet the requirements of the implementation. Various strategies such as sensitization (via television programs, newspapers and radio), cultural change and process change management teams (CCPMT) processes were instituted. Through the CCPMT workshops and training sessions were provided to help desk personnel who were tasked with the responsibility of mediating communication between other end-users and the technical staff. However, these training programs were not all inclusive since some employees were e-illiterate and others were not ready for the drastic take over by technology.

6.2 Phase Two: Data and System Integration

This phase led to the integration of data from the two major public financial institutions: the Bank of Ghana (BoG), and the Ghana Revenue Authority. The integration was however constrained by institutional factors (policies and bureaucratic processes).

In the second phase, the treasury's single account was activated and integrated with the existing public accounts. The personnel payroll was also integrated and activated on the platform. The purpose of integrating these modules was to encourage real-time data sharing between the human resource module and other modules. There was donor review during this stage and training of the available staff. This unearthed the challenge of staff capacity, with regards to e-literacy rate. This, therefore, extended the required time for staff training and equipping the help desk with communication tools that monitored call logs in real-time. Other challenges included lack of information sharing culture, manual or unavailable data and fear of technology.

6.3 Phase Three: System Activation and Training

In this phase, the various financial modules were activated, and additional training was provided for the local technical teams. The payroll was upgraded with initial data from the Ghana Education Service. The budget process workflow was also activated. Additional training was conducted for the payroll processing department staff, internal audit teams and cashiers during this phase.

The final phase was not devoid of challenges. The challenges included the focus of parliament committees on outputs rather than activities, bureaucratic nature of the software (protocols), inadequate ICT infrastructure, staff resistance and inadequate change management practices.

7 Institutional Implications

This section draws on the concepts of the regulatory, normative and cultural-cognitive institutional pillars to analyze and provide implications for the case description and the system implementation process.

7.1 Regulatory

GIFMIS implementation was supported by both national and international legal frameworks that demanded strict compliance. These laws included; the Financial Administration Act (FAR) Act 2003, Act 654, subsection FAR

section 306 of LI 1802, section FAR LI 1802 part XIV LI 1803 while the international laws were the Sarbanes Oxley Act of 2002 and SOX Public Company Accounting Oversight Board (PACAOB, 2004).

Section 306 of FAR LI 1802, for instance, required the payroll system to go through a validation process before approval by departments. This was to control the issue of ghost names in the payroll. Also, Part XIV of FAR Act 293 requires the different authorization process of approving payment vouchers and Act 2003 (654) obliged heads of departments to notify CAGD of changes in responsibilities. These internal laws supported the in-built restricted access to data on the software. Thus roles were defined which determined data that can be accessed and the responsibilities. FAR 305 stipulated the sanctions for non-validation, which included withholding of salary and extra monetary charge if non-compliance led to financial lost to the state. It further enforced notification of any transfers, death, resignation, retirement and vacation of the post, failure to comply could lead to financial sanctions. On the other hand, payments made to an unintended person was recovered based on FAR (30) 298 and was considered as negligence on the part of the payee.

7.2   Normative

This pillar is focused on national and international shared values and standards that affected the implementation. Although this demanded compliance, it was not forceful, and thus non-compliance was not punishable as with the regulatory pillar. The international standards included the establishment of a GIFMIS secretariat made up of project directors and specialists for each module to be implemented. Political support, which led to the institution of a Steering and Executive committees made up of various members of parliament. GIFMIS internal support teams (GIST) which consisted of trainers, advocates, internal oracle expects and project coordinators. The normative pillar also led to phased but independent approach to implementation. It also ensured the availability of ICT infrastructure to aid in the implementation process. The national standard, on the other hand, entailed the establishment of monitoring and evaluating teams and having a centralized treasury.

Another normative standard was internal donor support. GIFMIS was supported by the World Bank, DFID of UK, European Commission, European Union and DANIDA. Requirements of donor support included the provision of consultants to help in implementation and training of local end-users. The donors also provided financial support, assessment of the implementation process.

7.3   Cultural-Cognitive

The cultural-cognitive pillar brought to light the effects of traditionally acceptable ways at the agency. Traditionally held concepts like attitude towards agency and legacy systems played a major role in the implementation, for instance, there were delays in data migration. Attitude toward legacy systems led to the belief that migrating from such systems will distort culturally accepted principles that have been protected and transferred from one generation to another. This affected implementation of GIFMIS, which necessitate either upgrading or scrubbing out legacy systems. This caused fierce disapproval by some users as they were not willing to accept either the upgrade or the new system at the agency.

Also, apathy and bureaucratic structures which gave the end-users a sense of power over various departments and within the departments was a challenge. To them, the new solution was taking over their rights as users. The end-users devised resistance strategies such as lack of ownership and commitment to the new software. They, therefore, viewed the new solution in light of the previous solutions that have failed over time, which triggered their unwillingness to accept the change. The implemented solution fed on the culture of 'fear' of losing their jobs to 'machines'. Though the secretariat embarked on a rigorous sensitization process these attitudes could not be changed.

On the other hand, there was evidence of unwritten internalized laws to which end-users were forced to comply. These included: allowing "friends" or subordinates to get "jobs did" and procrastination. These unwritten laws introduced specific attitudes that guided the way 'things were done' among end-users. Non-compliance was not punishable but attracted informal behaviors like gossip and insults from other end-users.

8   Discussion

This section presents a discussion of the institutional factors based on the findings and further relate it to literature. The discussion is in response to the research question with reference from the pillar view of the new institutional theory.

8.1 Regulatory Effects

The findings highlighted the specific national and international laws that affected the implementation of the system. There has been a shift from the use of paper-based financial systems to integrated IS-based systems in public sectors [36]. This, therefore, requires relevant regulatory frameworks to support such systems. These laws provided specific guidelines for implementation; these guidelines include different levels of access protected by passwords and usernames. This limited activities of end-users on the platform to only their specific job requirements. Currie [37], for instance, noted the changes in public finances due to the provisions of the SOX (PCAOB 2004).

The changes have made IT professionals and senior executives more accountable for their activities on financial software platforms. Non-compliance, as noted in the findings, was punishable by provisions of the law and thus are more cohesive and legally binding. This implies that formal pressures are enforced based on the laws [38,39]. For instance, the 'view only' access by both internal and external auditors ensure that the integrity and confidentiality of the financial data are preserved. Additional consequences of the laws were the inability of directors to delegate duties to subordinates which encouraged the separation of duties. Complex systems are adequately managed with the aid of separation of duties depending on responsibilities and levels of access [40]. Furthermore, global completion coupled with regulatory requirements is a challenge for public sectors and donor investors [17].

However, there was no regulatory framework to guide supplementary budgeting which is an essential part of the budgeting process in Ghana. Thus although e-government regulatory compliance is required and enforced, in this study end-users noted the inadequacy of the laws governing the system. Government regulatory frameworks have the capability of hindering the understanding of citizens because they are mostly complex [41]. Regulatory compliance of IS initiatives in public sectors is mostly a challenge [42], and donor agencies such as the World Bank can influence such laws [43].

8.2 Normative Effects

The normative pillar as noted in the findings is centered on both national and international standards which requires obligation but are not coercive. The international standards include donor support, training and phased implementation approach. Donor support is considered as an inevitable phenomenon before, during and after implementing the software [44]. Their inescapable role is based on the timely financial information they provide with regards to the software [6]. The phased approach in Ghana encountered specific challenges which resulted in satisfactory results and a continuation of the implementation process. The challenges include inadequate ICT infrastructure, network connectivity and irregular power supply. The software lacked end-user or stakeholder ownership and commitment. Heads of the various departments were also not willing to share financial data in their possessions which were needed for effective piloting, in most cases, the required data was either unavailable or in paper-based formats. Another requirement was the establishment of a secretariat, executive and steering committees to oversee the implementation and provide political support.

8.3 Cultural-Cognitive Effects

Inferring from the findings, the cultural-cognitive pillar played a significant role in the implementation of GIFMIS in Ghana. The awareness and understating of the role of public sector culture are necessary as it unravels the reasons guiding the implementation of specific reforms enabled by ICT [45]. Familiarity with legacy systems created a culture of dependence which created a behavior of unwillingness to share data. Over-dependence on legacy systems informed end-user reluctance to accept the new software which created lack of commitment and ownership. This concept further led to delays due to the integration of the payroll module from the BPEMS to the GIFMIS platform, even though the GIFMIS has a payroll module. Excessive bureaucracy and peculiar culture in the public sector contributed to delays in implementing IS [46].

9   Conclusion and Implications

The purpose of the research was to unearth and understand the role institutional factors play in the implementation of e-government financial systems in a developing country. The contribution of this research is grounded in the provision of rich insight through the application of the new institutional theory to study a particular e-government initiative. In addition, although interpretivist research does not generalize statistically, it gives room for theoretical generalization established by empirical evidence of an IS within a particular context. This study offers rich insight into e-government financial systems through the lens of new institutional theory and thereby unearthing the

regulatory, normative and cultural-cognitive effects of the software from the perspective of developing countries. This is a move away from the focus on the challenges and failure centered research in e-government in developing countries. The focus of this study offers rich insight into the regulator, normative and cultural-cognitive implications of an e-government initiative in developing countries.

This study unearths the need for IS researchers to consider various e-government initiatives from a socio-technical point of view through the institutional lens within a particular context. It also presents practical implications for donor partners and governments of developing countries and recommends that they should not overlook the unique effects of laws, norms and culture on e-government initiatives. Also, ICT skills and end-user commitment, for instance, should be critically assessed before and after implementing e-government projects. Internal legal frameworks that govern e-government projects in developing countries should be considered critically and update those that need to be adapted before implementation. Laws should be communicated and should be understood by end-users. Thus developing countries should update their laws to make room for e-enabled changes in the public sector.

The main limitation of this study is that the research is grounded in a single case study. Nevertheless, interpretivist research findings can be generalized to IS projects exhibiting the same characteristics. Also, the study employed a deductive approach which limited its findings and analysis to the pillars of the new institutional theory, but interpretivist research can also contribute to theory by applying it to specific phenomena. Future studies could adopt non-deterministic theories and also focus on other agencies within CAGD to uncover unique institutional factors that have affected the implementation of GIFMIS in Ghana and other developing countries.

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Definitions of e-Government: Identifying the Blind Spots

Carl Jacobs ✉[1] [0000-0003-1720-1290] and Ulrike Rivett [1] [0000-0002-7708-8018]

[1] University of Cape Town, Cape Town, Western Cape, South Africa
✉carljacobsza@icloud.com

Abstract. This paper presents a review of accepted and applied definitions of e-government, and a comparison with Ramaprasad, Sánchez-Ortiz, and Syn's [25] ontology of e-government, which constitutes the domain of e-government both systematically and systemically. By applying a hermeneutic approach to literature reviews, this paper shows that our current understanding of e-government rests on limited and potentially outdated definitions, whose relevance and acceptability in the current landscape of e-government research and practice are questionable – they reached their evolutionary peak in 2003, and only account for 40% of the ontology of e-government. As such, the paper provides the foundation for a critical reflection of currently accepted definitions of e-government, and their validity as a basis of action the world over.

Keywords: e-Government, Critical Systems Heuristics, ICT4D.

1   Introduction

A definition is, according to Oxford Dictionaries, "an exact statement or description of the nature, scope, or meaning of something" [1, par. 2]. As such, a definition of e-government should, in theory, be an exact statement or description of the nature, scope, or meaning of e-government.

What gives a definition of e-government meaning and merit, is the difference such a definition makes in practice. Definitions need to be relevant and acceptable to those affected by the consequences of their real-world applications [2,3].

As this paper shows, current definitions of e-government only account for 40% of the domain of e-government, having not evolved since 2003. This brings their relevance and acceptability into question. By unpacking these concerns, this paper provides the foundation for a critical reflection of our currently accepted definitions of e-government, and their validity as bases of action, both in research and in practice.

The remainder of this paper is structured as follows: First, an overview of the evolution of e-government definitions is presented. This is followed by a description of the employed research methodology. The results are then presented, followed by a discussion of these results. The paper ends with some concluding thoughts.

2   Definitions of e-Government – Their Evolution

Referring to Table 1, below, it can be seen that in the year 2000, e-government was very much about the use of technology to enhance or improve access to information and delivery of services to citizens and businesses [4,5,6]. 2001 saw a slight shift in emphasis on the type of technology i.e., on the Internet [6,7].

2002 saw the introduction of the concept of ICTs, and the use of such ICTs for not just access to information and delivery of services, but also transformation of governments [10,11,12]. While the use of ICTs remained core to the definitions of 2003, a shift towards the potential for improved efficiency, effectiveness, transparency, and accountability began to emerge [13,14,15,16,17,18]. It would appear, however, that 2003 saw the last real evolutionary step in definitions of e-government.

The definitions of both Ciborra and Navarra [19] in 2005, and Dada [20] in 2006, added nothing new. While mentioning the application of e-commerce concepts to government operations (which was novel at the time), Rahman's [21] definition also added nothing new. Similarly, Wang and Liao's [22] definition repeated much of the same from definitions before. Besides mentioning some specific technologies over and above the Internet (albeit outdated technologies by today's standards), Almarabeh and AbuAli's [23] definition also offered nothing new. And as for the World Bank's [24] definition of 2014 – not only did it not add anything new, it was recycled from 2008.

The reasons for and consequences of definitions of e-government having reached their evolutionary peak in 2003 constitutes the remainder of this paper.

Table 7. Sources of the 23 original definitions of e-government

Year	Definitions of e-Government
2000	*"government's use of technology, particularly web-based Internet applications, to enhance the access to and delivery of government information and service to citizens, business partners, employees, other agencies, and government entities"* [4, p. 3]
2000	*"any way technology is used to help simplify and automate transactions between governments and constituents, businesses, or other governments"* [5, p. 21]
2000	*"using information technology to deliver government services directly to the customer 24/7"* [6, p. 1]
2001	*"a government that makes information and services available to its citizens increasingly through the web"* [7, p. 26]
2001	*"providing or attainment of information, services or products through electronic means"* [8, p. 92]
2001	*"the ability for anyone visiting the city website to communicate and/or interact with the city via the Internet in any way more sophisticated than a simple email letter to the generic city (or webmaster) email address provided at the site"* [9, p. 297]
2002	*"information and communication technologies (ICTs) supporting and transforming the external workings of government by processing and communicating data"* [10, p. 98]
2002	*"all information and communication technology (ICT) platforms and applications in use by the public sector"* [11, p. 1]
2002	*"the use by the Government of web-based Internet applications and other information technologies, combined with processes that implement these technologies, to . . . enhance the access to and delivery of Government information and services to the public, other agencies, and other Government entities; or . . . bring about improvements in Government operations that may include effectiveness, efficiency, service quality, or transformation"* [12, p. 2902]
2003	*"a powerful means . . . to deliver better quality public services, reduce waiting times and improve cost-effectiveness, raise productivity, and improve transparency and accountability [or] the use of ICT combined with organisational change and new skills in order to improve public services, democratic processes and public policies"* [13, p. 4]
2003	*"the use of information and communication technologies (ICTs) to improve the activities of public sector operations . . . bring[ing] with it the promise of greater efficiency and effectiveness of public sector operations"* [14, p. 2]
2003	*"making the delivery of Government services more efficient"* [15, p. 201]

2003   *"enables both efficiency and democracy to be met more cheaply"* [16, p. 1]

2003   *"encompass[ing] all aspects of government activity . . . [and offering] a new form of government built around ICTs"* [17, p. 23]

2003   *"E-government basically utilizes the application of ICTs to transform the efficiency,*

effectiveness, transparency and accountability of informational and transactional exchanges, and to empower citizens through access and use of information. E-government aims to make these exchanges and interaction between government and citizens (G2C), government and business enterprises (G2B), and inter-agency relationships (G2G) more friendly, convenient, transparent, and inexpensive" [18, p. 1]

2005   *"reorganization of government's internal and external information flows, activities, and functions in order to shift the delivery of government services over the Internet"* [19, p. 142]

2006   *"a belief in the ability of technology to achieve high levels of improvement in various areas of government"* [20, p. 1]

2007   *"e-Government applies concepts of electronic commerce . . . to government operations . . . e-Government refers to government's use of information technologies . . . to exchange information and services with citizens, entrepreneurs, and other arms of governmen . . . e-Government comprises of government activities that takes place by digital processes over a computer network, usually the Internet, among the government and members of the public and other entities in the private sector"* [21, p. 226]

2008   *"government's use of ICT . . . to enhance the access to and delivery of government information and service to citizens, business partners, employees, and other agencies and entities"* [22, p. 718]

2010   *"government use of information communication technologies to offer for citizens and businesses the opportunity to interact and conduct business with government by using different electronic media such as telephone touch pad, fax, smart cards, self-service kiosks, e-mail / Internet, and EDI. It is about how government organizes itself: its administration, rules, regulations and frameworks set out to carry out service delivery and to co-ordinate, communicate and integrate processes within itself"* [23, p. 30]

2014   *"the use by government agencies of information technologies (such as wide area networks, the Internet, and mobile computing) to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, more transparency, greater convenience, more revenue growth, and lower costs"* [24, p. 144]

3 Research Objectives & Methodology

The objective of this paper is to answer the following research question:

RQ1: How do the current definitions of e-government compare to Ramaprasad, Sánchez-Ortiz, and Syn's [25] ontology of e-government?

The research methodology is structured accordingly, using the following steps:

1. Searching for and acquiring definitions of e-government using the searching and acquiring circle from Boell and Cecez-Kecmanovic's [26] hermeneutic approach to literature reviews.
2. Drilling down into this acquired data using snowballing, a concept borrowed from Boell and Cecez-Kecmanovic's [26] hermeneutic approach to literature reviews.
3. Comparing the acquired definitions against Ramaprasad, Sánchez-Ortiz, and Syn's [25] ontology of e-government.

Each step is described in more detail below.

3.1 Step 1: Searching for and Acquiring Definitions of e-Government

The hermeneutic approach to literature reviews is unique for one simple reason: it draws attention to and emphasizes the role of literature searches. This is something other approaches do not do in any detail [26]. It achieves this through 7 steps: *Searching*, *Sorting*, *Selecting*, *Acquiring*, *Reading*, *Identifying*, and *Refining*. Together these steps make up, what Boell and Cecez-Kecmanovic [26] call, the *Search and Acquisition Circle*. The steps, as followed in this study, are presented below.

Searching involved entering the following terms into Google Scholar: *e-government*, *egovernment*, *e-government definition*, *egovernment definition*, *define e-government*, *define e-government*, *defining e-government*, and *defining egovernment*. Google Scholar provides a "good multidisciplinary coverage of academic journals with the additional benefit of allowing citation searches" [26, p. 278]. Another reason for using Google Scholar is its ability to sort via citations (*Sorting*). Searching the terms mentioned above retrieved thousands of documents. Sorting retrievals by number of citations identified "landmark papers that are often referred to by others" [26, p. 271].

After completing the *Search* and *Sorting*, publications had to be *Selected*. While Boell and Cecez-Kecmanovic [26] describe abstracts as being useful in this regard, not many publications that provide a definition of e-government do so in their abstracts. As such, a small number of publications with high relevance were selected. This is acceptable within the hermeneutic framework – after these are read, "subsequent iterations of the searching circle will allow one to pick up additional publications that initially were not selected" [26, p. 271]. It is also for this reason that, in this study, the steps of *Selecting* and *Acquiring* were combined.

The acquired publications were subsequently searched for the following terms: *define*, *defined*, *defining*, *definition*. As this study was interested in formalized definitions of e-government specifically, those that did not contain these terms were discarded.

After *Acquiring* came *Reading* and *Identifying*. Publications were read to identify original[2] definitions of e-government. In the case where a publication cited another scholar's definition, a note of the reference was made. *Reading* and *Identifying* is, according to Boell and Cecez-Kecmanovic the "most important step for informing searches" [26, p. 271].

It took three iterations of the steps described above to reach a point of saturation. As Boell and Cecez-Kecmanovic [26] point out, the *Search and Acquisition Circle* is complete when saturation is reached: "While no formal criteria for saturation can be established, one indicator is diminishing novelty when reading additional literature and only marginal improvements in understanding the research problem" [26, p. 272] – in the case of this study, until no new original definitions were found.

Step 1 resulted in 18 publications. The next step was to drill down into these publications using snowballing.

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[2] Original refers in this context to a definition of e-government provided by the author(s) in their own words i.e., not citing the definition(s) of other scholars. In addition, definition refers in this context to a formalized, exact statement or paragraph about what e-government is.

3.2 Step 2: Drilling Down into Literature through Snowballing

Snowballing is, according to Boell and Cecez-Kecmanovic, a good "method that can be used to identify further relevant literature after some relevant publications are identified" [26, p. 281]. Its key characteristic is that it goes back in time. While some might view this as a disadvantage [26], it worked to the advantage of this study. As will be shown, the most recent (and sometimes highly cited papers) were often citing older definitions of e-government, without providing their own original ones.

An example helps to illustrate this process. Starting with Madsen, Berger, and Phythian [27] (see Fig. 1 below) one can see they referenced three other scholars i.e., Layne and Lee [28], Reddick [29], and Verdegem and Verleye [30]. These scholars, in turn, referenced Zweers and Planqué [8], Millard [16], the Organisation for Economic Co-operation and Development (OECD) [17], and McClure [4].
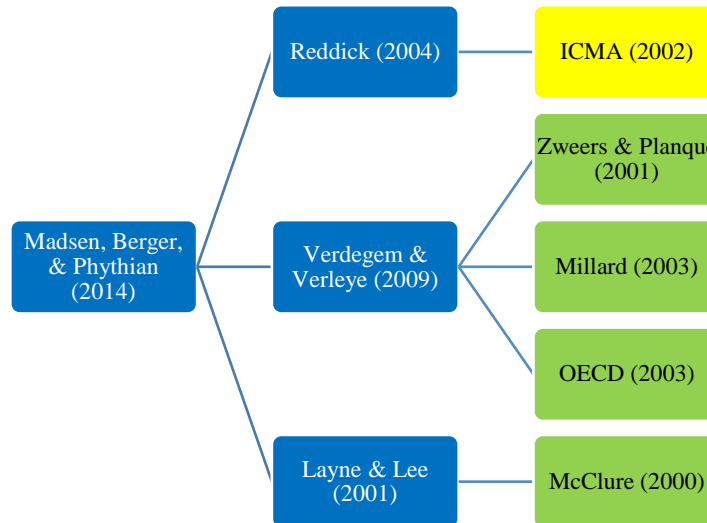
Fig. 3. An example of drilling down for original definitions of e-government

The color coding works as follows: Blue blocks indicate no original definition by said author(s). Yellow blocks indicate an unobtainable source. Green blocks indicate original definitions by the author(s). From the above example, one can see that Madsen, Berger, and Phythian [27] are essentially referring to four original, but substantially older definitions of e-government.

In certain instances, scholars would reference other scholars, while also providing their own original definition. There were also instances where snowballing lead to no original definition. This was either due to an incorrect citation by the preceding source or a publication being unobtainable[3].

In an iterative fashion, the newly acquired references were read to identify further original definitions of e-government. Once again, in the case where a publication cited another scholar's definition, a note of the reference was made. This process was repeated until sources only providing an original definition were found, i.e., sources not citing other scholar's definitions.

While 38 publications were identified during the first iteration of Step 2, only 22 could be acquired. The second iteration of Step 2 (this time using the 22 new publications) resulted in 13 additional publications being identified. However, only 4 of these could be acquired. The end result was a total of 21 publications providing their own original definitions. One of these publications, Yigitcanlar [18], provided 3 distinct definitions, bringing the total number of original defnitions of e-government to 23. The sources of these defnitions are presented in Table 1, under *Results*.

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[3] While Boell and Cecez-Kecmanovic state that "[l]imited access should not be an excuse for excluding publications believed to be of importance" [26, p. 271], it was the case that not all cited references could be obtained – either they could not be located or they were not held within the university's licenses. If there were any limitation to this study, it would be this.

3.3   Step 3: Comparing the Definitions of e-Government against the Ontology

Before describing the steps of comparison, an overview of the ontology itself is presented. Developed to map the state of e-government research and practice, and analyze the gaps existing between them, Ramaprasad, Sánchez-Ortiz, and Syn's [25] ontology deconstructs e-government into four categories, namely: *Medium*, *Entity*, *Service*, and *Outcomes*. These are, in turn, each made up of various elements (see Figure 2 below).

Fig. 4. Ontology of e-government [25, p. 3]

The ontology allows for a total of 315 encapsulated components. As Ramaprasad, Sánchez-Ortiz, and Syn state, "these components constitute the domain of eGovernment systematically and systemically" [25, p. 5]. Furthermore, they state that "the ontology can be extended by adding new dimensions . . . extending the taxonomies by adding new categories, refining them by adding sub-categories, and coarsening them by combining categories" [25, p. 11].

Because of the generic nature of many definitions of e-government (i.e., being coarse), the ontology was modified for this study. The following elements were added: "ICTs" and "Internet" under Electronic Mediums, "Unspecified" under Government Entities, and "Unspecified" under Service. In this way, elements, common to definitions of e-government, would not be left out. The process of comparison is best described using an example. Almarabeh and AbuAli define e-government as:

"government use of information communication technologies to offer for citizens and businesses the opportunity to interact and conduct business with government by using different electronic media such as telephone touch pad, fax, smart cards, self-service kiosks, e-mail/Internet, and EDI. It is about how government organizes itself: its administration, rules, regulations and frameworks set out to carry out service delivery and to co-ordinate, communicate and integrate processes within itself" [23, p. 30].

The definition is carefully read through, noting the elements of the ontology it mentions. In this instance:

- Under the category of *Medium*, it mentions ICTs and PC/Web/Internet;
- Under the category of *Entity*, it mentions Governments (Unspecified), Citizens, and Businesses;
- Under the category of *Service*, it mentions Information, Transaction, and Interaction; and
- Under the category of *Outcomes*, it mentions e-Government.

This process was repeated for each of the 23 original definitions. An Excel spreadsheet was setup to keep track of the elements mentioned in each definition. The result was a set of monads[4] and dyads[5] for the 23 definitions (discussed later).

These monadic and dyadic distributions allowed for gaps to be identified. According to Ramaprasad, Sánchez-Ortiz, and Syn [25], gaps can be positive (an over emphasis of ontological components), negative (an under emphasis of ontological components), or zero (the correct emphasis of ontological components). Determining such gaps comes down to how frequently elements of the ontology occur within the definitions. Frequently occurring elements are referred to as 'bright' spots, and infrequently occurring ones as 'light' spots. Elements that do not occur at all are referred to as 'blind/blank' spots. Collectively, these refer to the luminosity of elements. While luminosity may be indicative of a gap, there "are no norms about the level of emphases . . . [and] whether [or not] a particular level of luminosity of a monad or dyad is correct" [25, p. 9] cannot be asserted. The luminosities are instead presented in a way that allows a consensus to emerge. The end result is a picture of which ontological elements the 23 original definitions of e-government overemphasize, underemphasize, correctly emphasize, or don't emphasize at all. In other words, it helps identify their blind spots.

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[4] The frequency of occurrence of each element.
[5] The frequency of occurrence of each pair of elements.

4   Results

Table 8. Sources of the 23 original definitions of e-government

Author(s)	Year	Page Number
Almarabeh & AbuAli [23]	2010	p. 30
Bannister & Remenyi [15]	2003	p. 201
Ciborra & Navarra [19]	2005	p. 142
Dada [20]	2006	p. 1
Duffy [6]	2000	p. 1
European Commission [13]	2003	p. 4
Fountain [7]	2001	p. 26
Heeks [10]	2002	p. 98
Heeks [14]	2003	p. 2
Kaylor, Deshazo, & Van Eck [9]	2001	p. 297
McClure [4]	2000	p. 3
Millard [16]	2003	p. 1
Organisation for Economic Co-operation and Development [17]	2003	p. 23
Rahman [21]	2007	p. 226
Sprecher [5]	2000	p. 21
The World Bank [24]	2014	p. 144
United Nations & American Society for Public Administration [11]	2002	p. 1
United States Congress [12]	2002	p. 2902
Wang & Liao [22]	2008	p. 718
Yigitcanlar [18]	2003	p. 1
Yigitcanlar [18]	2003	p. 3
Yigitcanlar [18]	2003	p. 4
Zweers & Planqué [8]	2001	p. 92

As per Step 3 of the research methodology, the 23 definitions were compared against Ramaprasad, Sánchez-Ortiz, and Syn's [25] ontology of e-government. Table 3 shows the monadic distribution for the 23 original definitions i.e., the frequency of occurrence of each ontological element in the 23 definitions.

Table 9. Monadic distribution for the 23 original definitions of e-government

Categories	Elements	Frequency of occurrence (%)
MEDIUM	People	0
	Paper	0
	ICTs	87
	PC/Web/Internet	61

	Smartphone	13
	Social Media	0
ENTITY	Unspecified Level of Government	91
	Local/Municipal	0
	Provincial/State	4
	Central/Federal	0
	Intermediaries	4
	Citizens	65
	Businesses	52
	NGOs	4
SERVICE	Unspecified Service Type	39
	Information	61
	Transaction	39
	Interaction	26
OUTCOMES	e-Government	100
	e-Governance[6]	4
	e-Democracy	4

Looking at Table 2, we see that e-Government (under *Outcomes*) was the most frequently occurring element, at 100%. This is, however, not surprising since the ontology was applied to definitions of e-government. Similarly, it is not surprising that ICTs (87%), Governments (Unspecified) (91%), and Information (61%) were the most frequently occurring elements under *Medium*, *Entity*, and *Service* respectively. Figure 3 below shows the dyadic distribution for the 23 definitions i.e., the frequency of co-occurrence for each pair of elements in the ontology (shown in percentages). The shading is representative of the frequency i.e., blind spots are the darkest (those elements not occurring at all), and bright spots the lightest (those elements occurring the most).

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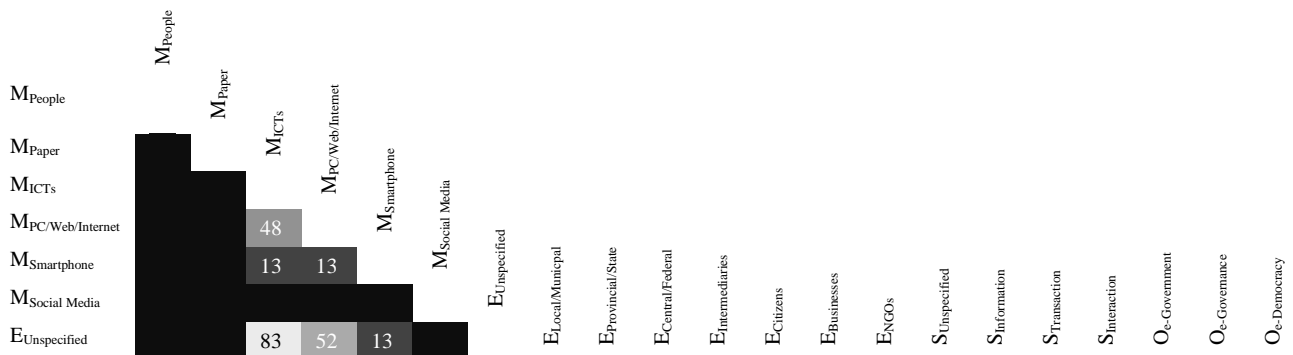
[6] It is important to reiterate that this study is concerned with definitions of 'e-government' and not 'e-governance'. E-Government is viewed as the first stage of evolution to e-governance, with the latter referring to "the processes that are based on the intervention of the citizens and their representatives in public decisions relative to the government of society" [25, p. 5].

Fig. 5. Dyadic distribution for the 23 original definitions of e-government

	ICTs	PC/Web/Internet	Smartphones	Gov (Unspec.)	E_Provincial/State	E_Intermediaries	E_Citizens	E_Businesses	E_NGOs	S_Unspecified	S_Information	S_Transaction	S_Interaction
E_Local/Municpal													
E_Provincial/State		4											
E_Central/Federal													
E_Intermediaries		4		4									
E_Citizens	52	52	13	57	4	4							
E_Businesses	39	43	13	48	4	4	52						
E_NGOs		4		4		4	4	4					
S_Unspecified	39	13	4	35			17	9					
S_Information	48	48	9	57	4	4	48	43	4				
S_Transaction	26	30	9	35	4	4	35	35	4	39			
S_Interaction	13	26	9	22	4	4	26	26	4	26	26		
O_e-Government	87	61	13	91	4	4	65	52	4	39	61	39	26
O_e-Governance	4			4						4		4	
O_e-Democracy	4			4						4		4	4

Looking at Fig. 3 we see that the most frequently occurring dyad is e-Government (*Outcomes*) and Unspecified Governments (*Entity*) at 91%. This is followed by e-Government (*Outcomes*) and ICTs (*Medium*) at 87%. It is, however, not surprising that dyads containing e-Government (*Outcomes*) should occur the most – the ontology was, after all, applied to definitions of e-government. Ignoring, for the moment, dyads containing this obvious element, we see that:

- The most frequently occurring dyad is ICTs (*Medium*) and Unspecified Governments (*Entity*). In other words, 83% of the definitions for e-government mention the use of an ICT based system for governments.
- This is followed by the dyad Unspecified Governments (*Entity*) and Citizens (*Entity*). That is, 57% of the definitions mention the use of some medium based system for governments and citizens to provide or obtain services.
- 52% of the definitions mention PCs, Web, or Internet based systems for governments (this dyad being PC/Web/Internet (*Medium*) and Unspecified Governments (*Entity*)).
- Similarly, 52% of the definitions mention PCs, Web, or Internet based systems for citizens (this dyad being PC/Web/Internet (*Medium*) and Citizens (*Entity*)).
- In addition, 43% of the definitions mention PCs, Web, or Internet based systems for businesses (this dyad being PC/Web/Internet (*Medium*) and Businesses (*Entity*).
- 48% of the definitions mention using PCs, the Web, or the Internet for providing or obtaining information services (this dyad being PC/Web/Internet (*Medium*) and Information (*Service*)).
- 30% of the definitions mention using PCs, the Web, or the Internet for providing or obtaining transaction services (this dyad being PC/Web/Internet (*Medium*) and Transaction (*Service*)).
- 26% of the definitions mention using PCs, the Web, or the Internet for providing or obtaining interaction services (this dyad being PC/Web/Internet (*Medium*) and Interaction (*Service*)).
- Only 9% of the definitions mention using smartphones to provide or obtain information, transaction, or interactions services (Smartphones (*Medium*) and Information (*Services*); Smartphones (*Medium*) and Transaction (*Services*); and Smartphones (*Medium*) and Interaction (*Services*).
- None of the definitions mention using social media to provide or obtain information, transaction, or interactions services (Social Media (*Medium*) and Information (*Services*); Social Media (*Medium*) and Transaction (*Services*); and Social Media (*Medium*) and Interaction (*Services*).
- Similarly, there are no definitions which mention the use of people or paper-based systems.

5   Discussion

With reference to Table 2, none of the definitions mention the use of People, Paper, or Social Media based systems for e-government. Additionally, there is very little specificity as to the level of government that e-government is aimed at.

If Fig. 3 represents the domain of e-government both systematically and systemically, one would expect definitions of e-government to cover most of this domain. This is, however, not the case – the 23 original definitions of e-government account for only 40% of the domain of e-government. The remaining 60% is made up of blind spots.

Certain of these blind spots could be, what Ramaprasad, Sánchez-Ortiz, and Syn [25] refer to as, logical gaps. For instance, it is quite understandable that definitions of e-government do not mention the *Outcomes* of e-Governance and e-Democracy – the end goal of e-government is, generally speaking, e-government. The lack of specificity regarding the level of government is not surprising either.

One of the more concerning blind spots is the exclusion of people and paper-based systems. This is not a logical gap. As Ramaprasad, Sánchez-Ortiz, and Syn point out, "[people and paper continue] to be significant even in the most electronified systems. In conjunction with the electronic media they play a significant role in assuring the effectiveness of any eGovernment system. Paper is yet to be completely eliminated in government transactions; the emergence of Contact Centers . . . and public libraries . . . as intermediaries is recognition of the continuing importance of People" [25, p. 7].

Similarly, that social media is not mentioned in any of the definitions is concerning, especially given their current prevalence in our everyday life. The same goes for smartphones – only 13% of the definitions mention their use in achieving e-government.

Many of these gaps could be explained by the fact that even the youngest original definition of e-government is already eight years old [23]. Smartphones and social media were, in 2010, in their infancy[7]. (Remember, the World Bank [24] definition of 2014 is, as it turns out, a recycled definition from 2008)

While Almarabeh and AbuAli's [23] definition mentions specific (albeit outdated) technologies (such as telephone touch pads, fax, smart cards, self-service kiosks, e-mail, and the Internet), many other definitions simply group different technologies under one name – ICTs.

It is this coarseness, so common in definitions of e-government, that results in so few bright ontological elements (e.g., 83% of the definitions mentioning the use of an ICT based system for achieving e-government), and many light or blind spots.

As for the exclusion of people and paper – one explanation could be our techno-centric view of development and the future in general i.e., that technology will save us from ourselves.

6   Conclusion

This paper set out to determine what the current definitions of e-government are, and how they compare to Ramaprasad, Sánchez-Ortiz, and Syn's [25] ontology of e-government. It shows that our understanding of e-government currently rests on definitions whose relevance and acceptability are questionable at best – 60% of that which constitutes the domain of e-government currently falls into their blind spots.

For instance, none of the currently accepted and applied definitions mention the use of people, paper or social media-based systems, and very few mention the use of smartphones. While the lack of mentioning social media and smartphones could be chalked up to outdated definitions, people and paper remain significant, even in the most digitized governments.

Another factor contributing to the small number of bright ontological elements and abundance of blind spots, is the coarseness of many e-government definitions (i.e., their lack of specificity).

Future definitions of e-government need to thus be more specific, detailed, and up-to-date. They need to be relevant and acceptable to those affected by the consequences of their real-world applications. Exactly how one might go about redefining e-government for one's own context is, however, a topic for a future paper.

For now, it suffices to acknowledge and reflect on the fact that currently accepted and applied definitions of e-government are limited, outdated, and inadequate in accounting for the domain of e-government. And this needs to change.

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[7] For instance, the first Apple iPhone was launched in 2007, and Facebook became available to anyone with a valid email address only in 2006.

7   Future Work

As mentioned in the body of this paper, not all sources identified during snowballing were obtainable – either they could not be located, or they were not held within the university's licenses. It is thus entirely possible that other original definitions of e-government, not included in this study, exist. This is undoubtedly a limitation. That said, this paper also showed how definitions of e-government reached their evolutionary peak in 2003.

It is therefore unlikely that other original definitions, not included in this study, would have anything new to offer. Additionally, whether or not all possible original definitions of e-government were included is not the core purpose of this paper. Rather, it is to highlight that our currently accepted and applied definitions of e-government are limited, outdated, and inadequate.

To ensure that definitions are relevant and acceptable to those affected by the consequences of their real-world applications (i.e., citizens), future work needs to focus its attention on defining e-government from a citizen centered perspective. One starting point for future research, in this regard, could be Amartya Sen's [31] Capabilities Approach.

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Transitioning South Africa to a Cashless Economy as a Developing Country

Sidze Benjamin Mutheiwana[1] [https://orcid.org/0000-0002-5408-6626] and Roelien Brink[2]

Department of Applied Information Systems, University of Johannesburg, Bunting Road Campus, Auckland Park 2006, South Africa.
bennsid@gmail.com

Abstract. The subject of Cashless Economies continues to be a topic of conversation as countries around the world sought to move more towards digitals methods of conducting financial transactions. The purpose of this article is to determine whether transitioning towards a cashless economy could stimulate the overall economic development and provide more revenue for South Africa. A descriptive research approach was undertaken. The study was quantitative and it was used to uncover patterns and characteristics from the random sample of the population which undertook the study. Eighty participants took part in completing the questionnaire for the study. The results obtained showed larger amount of the population being readier to transition towards a cashless economy. The results also indicated that security was a main concern to a larger audience, although even besides that the usage of mobile and internet transacting among all age groups and gender was significantly high. The findings show that government should pay close attention to cashless services as this may facilitate to better tax compliance from all who are trading within the South African economy. Value was created by conducting research that could determine the effects of implementing cashless services and policies that enable such services in a country that is still regarded to be developing.

Keywords: bank, money, tax, policies, safety, technology, mobile.

1   Introduction

Cashless economies describe the gradual or radical transitioning of the economic payment system having moved from being highly cash based towards alternative non-cash based methods. This allows for various types of transactions to be settled without the use of cash (Adams, 2012). Transacting without the use of fiat money but rather with digital currency has become an interesting topic. Cash based transactions were the main preferred method of payment as compared to cashless EFT, online payments etc. Many countries worldwide, still have a population who prefer to conduct the majority of their transactions by means of using physical cash (Optile, 2017). Often discovered, the drive as to why these countries still perform a large amount of their transactions in cash due to numerous factors such as the lack of national and international regulations that regulate and govern how fiat money is used, the amount of money that an individual is allowed to carry or even the quantity that can be in one's position (Mieseigha and Ogbodo, 2013). As of 2016, more than 7 international countries were identified as conducting more than fifty percent of their economic transactions by means of cashless services (Business Today, 2016). The latter countries are striving towards having cashless economic systems. These countries include France, Netherlands, Singapore, Sweden, Canada, Belgium and The United Kingdom. They are striving towards creating systems which would allow the conduction and settling of transactions to take place by cashless means of transacting (Business Today, 2016). They have implemented solutions that enable them to become the most highly recognizable cashless economies in the world (Thomas, 2013). In Africa, countries such as Somaliland, Nigeria and lastly Kenya, who were the founders of M-Pesa, are among the leading African countries driving a move towards cashless systems (Hughes and Lonie, 2007; Twomey, 2013). The drive towards being cashless has risen due to a shift in the economic conditions of these countries and the introduction of policies that are being implemented in order to support such type of economies (Oluchukwu, 2014). Furthermore, some countries have benefitted from transitioning towards cashless economies. Benefits realized in countries such as Nigeria were faster means of transacting, decreased queuing and the improvement of hygiene due to reduced transmitted bacteria's from the circulation of physical cash etc. (Ejoh and Okpa, 2014). Furthermore, as much as the transitioning has been identified to be taking place in some of the African countries, there have been numerous challenges. The main challenge involves the lack of infrastructure within some African countries and which has in turn hindered their transition towards a cashless economy.

This article will provide insight to the findings of cashless economies and the characteristics that make-up such economy. The uniqueness of the study can be gathered from the insight gathered as to whether South Africa's economic development would be stimulated given that the number of cash based transactions are reduced

through the implementation of cashless supporting policies and solutions within the various economic sectors that provide value to the overall economic development of the country. Through the results obtained from the research study conducted, the study explains how transitioning towards a cashless economy could potentially influence the economic growth of the country. The outcomes may further detail how the state can benefit through more structured channels of tax collection which can be direct result from imposed tax compliance expected from the citizens and those who operate within the country using cashless services. With our high unemployment rates, the outcomes of the study may provide insightful information that explain how South Africa's employment rates could ultimately be affected by the implementation of cashless services. The research leading to this article was aimed at understanding whether South Africans and South Africa as a country is economically ready for a transition towards a cashless economy. The study will investigate the possibility in which a cashless economy could better the lives of the South African population through job development and more financial returns to the government which can ultimately provide better service delivery to the people.

2   Research Questions

Is a Cashless Economy more likely to stimulate South Africa's economic development?

3   Theoretical Framework

This section of the paper reviews the literature on cashless economies. This provides insight into countries that have become cashless economies, what they did to become such economies, challenges encountered during the transition towards a cashless economy and whether it is was of benefit for the economy by having these countries transition towards being cashless.

       Ejiorfor and Rasaki (2012) define a cashless economy as an economy where purchases and transactions are conducted mainly by a means of cashless online modes, they further elaborate that such economies rarely make use of physical money (Coins and Notes). Rashmi further defines cashless economies as economies where all types of monetary transactions are conducted by means of cashless modes not limited to e-banking, Point of Sale transactions, EFT and many more (Bindra, 2017). Transitioning towards a cashless economy for a developing country can be of benefit as it has the potential to curb the black market, furthermore such an economy has the potential of generating more revenue for the government by reducing tax avoidance from individuals and businesses that try and evade tax (Bindra, 2017).

       Muyiwa et al. (2013) along with Yaqub et al. (2013) further gave a similar definition towards a cashless economy. They both defined it as an economy that doesn't refer to a total absence of cash transactions, yet rather an economy where transactions can still be fully conducted without necessarily carrying physical cash as a means of exchange for goods and services (Muyiwa, Tunmibi and Afaha, 2013; Yaqub *et al.*, 2013).

       The definitions of the above will be used in this study as they all align to the same meaning that a cashless economy is one which still makes use of cash transaction while gradually transitioning towards cashless services. These theories work well by trying to transition an economy as South Africa towards a much more digital cashless environment. Muyiwa et al. (2013) and Yaqub et al. (2013) definitions are more relevant to this study, as they are firstly based on the African continent and secondly, economies that have started gradually yet still understand that a cashless economy does not equate to a total absence of cash transactions in that economy.

4   Literature Review

Cashless economies have been defined in various ways, mostly due to a researcher's subjective understanding of the topic. Cashless economies do not necessarily equate to the absence of cash circulating within the economy, rather these economies have alternative means of settling transactions for goods and services without making the use of physical cash (Muyiwa, Tunmibi and Afaha, 2013; Yaqub *et al.*, 2013). Adopting cashless policies and usage of transacting displaces the use of physical money, this in turns enables for various channels of transacting to be implemented and made use of e.g. Online Banking, Mobile banking and e-commerce. The adaptation of Point of Sale devices has also led more to the lack of need to carry around physical money through the enablement of credit and debit card transactions (Adams, 2012). Furthermore, the introduction of Electronic Fund along with real time settlement systems have provided channels in which people can transfer and immediately receive funds without the need of queuing at the bank and the delay of involved with it (Malik, 2014).

       According to research, there are no countries that are fully cashless economies, there are countries such as Kenya, Nigeria, Somaliland and South Africa that have already started their journey towards being cashless. In order to achieve this transition, countries such as Nigeria have policies in place that ensure drive towards going

cashless, in turn, should people conduct transaction that might be of large amounts of money, these policies enforce penalties upon the individuals or corporate bodies (Adams, 2012). Literature shows that over the years, countries have engaged in developing infrastructure that is to stimulate the transition towards cashless economies. Sweden is one of the countries that has shown a transition whereby in the 1950s, the value of physical cash in circulation in the country amounted for ten percent of the overall gross domestic product, by 2011, the value had dropped to 2.6%, this gives indication that proper implementation of the right cashless service infrastructure ultimately can reduce the amount of physical cash circulating in a country (Dalebrant, 2016). South Africa's cashless economy accounts for about thirty five percent of the overall tractions that are made, South Africa along with Nigeria are 2 African countries that are moving towards a cashless economy (Matambo and Schaefer, 2013).

In order for an economy to successfully transition towards a cashless economy, there are guidelines that would be required to be followed. It is important to first measure the number of people within an economy which make use of banks. Once that is established, they can check whether the services that are provided are both affordable for the people and or are at least readily available when requested. Secondly, it is important that to evaluate on the types of businesses that operate in that economy. Once that is established, the businesses should cater for and measure exactly how this affects consumers who are most likely to prefer the use of cash. Thirdly, it is important that there is a good understanding regarding the number of merchants that can be implemented to provide easier cashless payment method that eliminate the need to use physical cash. Lastly, in order for good implementation to take place, it is important that an assessment is done to assess and understand whether these economies implementing cashless policies have the expected infrastructure in place, this should also be inclusive of the quality of infrastructure (Thomas, 2013).

There are number impacts on the economy which can result from the transitioning towards a cashless economy, although there have not been any conclusive evidence that the transition does indeed impact the economy (Tee and Ong, 2016). Commercial activities in an economy will not be restricted by operating times of financial institutions, in a cashless economy, commercial activities can occur more on a 24/7 day basis, thus in turn impacting on the overall GDP of a country (Matambo and Schaefer, 2013).

Cashless economies reduce the number of cash related crimes (Muyiwa, Tunmibi and Afaha, 2013). South Africa's economic crimes are amount the highest in the world, CIT heists increased to more than 140 CIT conducted in the first six months of 2018 (Pijoos, 2018; PWC, 2018), which indicate quite a significant problem of a cash based economy. With such crimes, this sort of problems have the potential of impacting the countries safety rates which ultimately may have a detrimental impact on economic investments that the country could have opportunities to. An implementation of a cashless economy can therefore reduce such occurrences, it can also drives financial institutions to reducing the cost of their services fees as there will be less use and need to manage fiat currency at their respective branches (Muyiwa, Tunmibi and Afaha, 2013).

5   Research Methodology

The study conducted followed a descriptive research design approach that was quantitative in nature. One of the key outcomes of a descriptive research is to uncover and summarize the different characteristics that exists within the population or the topic that is being studied (Dulock, 1993; Zikmund, 2003). This study sought to uncover the readiness, influences, doubts and concerns of the South African population regarding going cashless, hence the descriptive research approach that has been chosen. To collect the data, a cross sectional approach was followed, data was collected by a means of sending out questionnaires to the population. Due to the research being quantitative and descriptive in nature, the questionnaire was sent out to the sample population by means of an online questionnaire, therefore only measuring the subjects once. Due to the nature of the study, the study was not aimed at picking up trends hence the questionnaire was not sent out at more than one point in time. The questionnaire was distributed to a sample population that included students, business owners, entrepreneurs and those who are unemployed. Convenience sampling was used where by, the sample that was easiest to access was the one which was requested to complete the questionnaire, hence the questionnaire was sent out through a link which enabled easy access to the sample as it turned out least rigorous and costly (Marshall, 1996).

5.1.   Sample and data collection

A survey that made use of a self-administered questionnaire was provided to the sample in order to gather data. The sample population used for the study were colleagues and students from the University of Johannesburg. Formal business owners who already have electronic methods of payments were also to be included in order to gather data regarding how they feel and perceive such as transitioning. Through the study, the population selected will be randomized, meaning that the research instrument will be provided to any of the above stated colleagues, friends, students, business and street business owners and those employees who already work in formal

environments, irrespective of who they are or what they do, the research instrument will also be provided to all. There will be no controlled group for this matter, and no one from the sample group should or can be directly influenced since the research strategy is aimed at having the respondents fill out the research instruments online. From the 80 questionnaires that had been issued out to the population, 64 of the questionnaires can be used for the sake of data analysis for this article. The survey was designed in a way in which it would collect the most valid and reliable data from the population identified. The advantage of using this method in gathering data is that of which the researcher need not be present when the questionnaire is being filled out. Secondly, this method will enable for the data that has been collected to be quantified and then used to compare change against other researches that have been conducted.

5.2. Data Analysis and Synthesis

There were numerous methods considered for quantitative data analysis required through this study. These include the analysis of frequencies of variables, including the difference that exist between them. This form of analysis was applied to the data collected through the research process. Given the type of research that is being conducted, which is focused on the sample population, inferential statistical was used as an analysis method which was particular to the research projects that sought to discover phenomena's from a sample population. Descriptive analysis is mainly focused on measuring an entire population characteristics and summarizing it, that can be achieved by rearranging the data, ordering it and manipulating it so that it gives of descriptive information (Zikmund, 2003). Inferential statistical analysis makes use of the collected information from the population to make estimations regarding the sample population that was identified, inferential analysis used ranking in order to sum up the overall analysis, it also takes consideration of statistical probability distribution based on the characters of the sample that was used whilst it also tries to the causality in the study by observing the dependent variable which is ultimately influenced by the Independent variable (Albrecht, no date). The inference of this sample population is derived from the researcher making use of the information that is collected from the sample. Furthermore, the data analysis is aimed at uncovering the different relationships and patterns by performing consistent multiple analysis on the data acquired and that which is being revealed through a constant analysis. While working with quantitative research, it is not common that there would be a need to use advanced modelling techniques in order to provide an explanations regarding how the collected data would address the research question. Inferential statistical analysis will provide descriptive statistics that can be used to provide justification as to how the sample population portrays an image of the entire population. Once the data that is to be acquired from the quantitative research has been identified and structured, the data can then be reported by the use of graphs and/or charts (Golafshani, 2003). The advantage regarding inferential statistical analysis is that it makes use of a sample population to represent the total population that is being studied.

6. Assumptions

Assumptions in a research project can be regarded as things that outside of the researchers control, although these things are also important as they make the study and its importance a whole more relevant (Simon, 2011). Furthermore, assumptions have the potential to shape the overall outcome of a study, including the methodology that is being used as well as the questions that can be asked within the study (Hathaway, 1995). The methodology used has the ability to reflect on both the epistemological and ontological assumptions. In such an instance, the methodology selected allows for the outcome knowledge of the study to be viewed as objective (Long, 2014). Below are some of the assumptions that were gathered for this study

- Participants who live in urban areas who will be taking part in this study are computer literate.
- Participants who live in urban areas who will be taking part in this study have access to an internet connection and a smart device or computer which they will use to partake in the research.
- People who reside in urban areas make use of current cashless service options such as EFT, POS transacting and internet banking to fulfill their monetary transactions.
- People who reside in cities and highly developed settlements make much more usage of cashless services unlike those coming from semi-urban to under developed areas.
- Foreign and local nationals conducting business in informal areas do not make use of cashless service terminals due to the policies and costs involved in using it.
- Black economy is formed up by people who are performing transactions off the radar so they do not get caught and their illegal transactions do not get traced.
- Implementing cash less economy will reduce the number of jobs available due to service payment terminals replacing the need for cashiers.

7.   Limitations of the study

Quantitative research methods have numerous limitation and issues such as the validity, which is aimed at measuring the accuracy of the results gained from the participants. Validity also measures the manner in which the results gained from the study can be applied to other settings. Quantitative research methods have reliability limitations where by the results from the respondents might not be consistent even placed under the same condition, respondents will be from different financial economic backgrounds, different occupational status, have different economical perspectives and might multiple culture and believes. This research method also has generalizability limitations, due to the study being conducted over a large population that have multiple economic backgrounds, the study can be generalized only based on the number of respondents from the different economic groups that have fully participated, the study requires that the research is conducted equally among different participants who come from different economic groups and who are both employed and not employed, only then can the outcomes be generalizable of the entire population as they study would have covered a greater portion of the overall population of the country.

This study was conducted online, the first limitation was that of participant's lack of knowledge to computer literacy which is required to in order to fill the online instrument. Given the computer illiteracy rate in South Africa that has to be considered, a number of the participants might require being physically approached and requested of their time in order to partake in the research project. Due to the digital divide, there are still a large number of people who do not have access to computers, smartphones and the internet. Some of these potential participants can be accessed or else assisted in filling in the research instrument were possible, given this limitation, a solution would be providing them with physical copies of the instrument which they can then fill and return.

Through an analysis of the topic that is being studied, the researcher has come to find that there is a limitation of prior research on the study that that is being conducted. Currently, most of the discussed findings have mainly been of India and Nigeria as the two countries that are seen most to be doing research studies on topics that are similar to the one that is being conducted which in turn gives an indication that there is room for the study to be conducted whilst there are possible numerous avenues that can be tapped into. In order to address this limitation, through the study, literature journals will be sourced directly from different universities, use google scholar and the University of Johannesburg database. There will also be a need to do a lot more reading on previous works from other sources and try to see where their sources come from, in that way the researcher can find themselves tapping into literature that is somewhat in the same line with what I am doing whilst uncovering many more relevant information.

8.   Ethical Consideration

In order to be aligned with proper research regulations and not to contravene any law protecting minors from conducting the study without obtaining consent. A consent form had to be fulfilled and agreed upon by all participants before they could partake in the study. This consent form also applied for minors, therefore the consent would require whomever was responsible for them to agree that the minor could partake in the study upon agreeing to the terms of the study. The Consent form required approval from the University of Johannesburg research committee, of which it was. Therefore any participant who wished to take part in the study first had to sign the Letter of consent in agreement to the terms stated on it.

9.   Analysis and Discussion

This major purpose of this section within the paper is to highlight the findings that have been gathered from the survey regarding transitioning South Africa to a cashless economy as a developing country. The sample population size of this current study was 80 people, this included both males and females of different age groups. The gathered data from the respondents showed that there were 14 invalid responses, thus reducing the valid sample population to 64. The analysis that is conducted for this study is solely based on the valid fulfilled responses of the 64 respondents who are of different backgrounds including different marital statuses, educational backgrounds, expenditure groups etc. Seventy four percent of the respondents are between the ages of 19 and 34 years of age, with the remaining twenty six percent being of the ages 35 and above. The results of the study showed that a larger majority of the respondents were single individuals with those of ages 19 to 34 accounting for sixty five percent of the entire population. The entire population had successfully completed, the results showed that more than 40 percent of the population had obtained an undergraduate degree, this is important when considering the time, ability and effort that would be required to ensure that the population is ICT ready and can learn to use the technologies required.
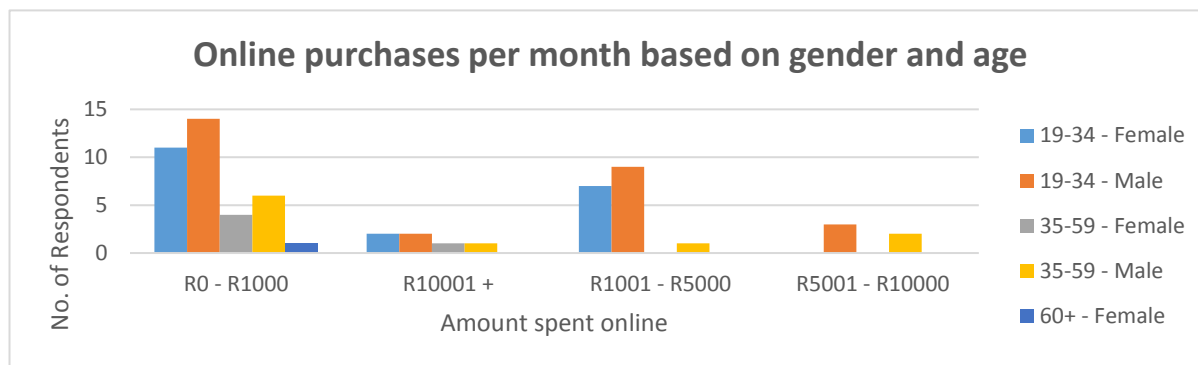
Fig 1. Online purchases based on gender and age

The results of the study indicated that more than seventy seven percent of the sample population were employed, the remaining twenty three percent were unemployed, with a 1.57% unemployment difference between males and females. The results indicate that a larger amount of the population receives income, which ties back to the hundred percent obtained of those who have a bank account. Bank accounts are important and serve as a backbone to towards cashless economies, income on the other hand resulting from some sort of employment is key to enabling cashless forms of transacting. Ownership of bank accounts allow for online purchasing and electronic fund transferring, One of the fasted growing forms of trades to date is online purchasing, this offers consumers the convenience of shopping at any time of day at a place of their convenience (Katawetawaraks and Wang, 2011)

The figure above show that sixty six percent of all online purchases are not of any amount more than R1000, with males between the ages of 19 and 34 being the highest users of online purchasing. Furthermore, it can be observed that the higher the value of online purchases that occur, the smaller the gap between males and females who are spending in that space, that can be seen by online purchases or R10000+ per month providing us with both three percent for males and females between the ages 19 – 34 seen to be transacting online. There is also a two percent online purchase presence of both males and females between the ages 35 – 59 that can be observed from the data obtained. Even though online purchasing and e-commerce transacting is still in its early stages, the above graph does show that people are slowly moving towards cashless ways of transacting. As the amount of mobile devices increase among the entire population, so will we see the increase in value and the amount of online purchases (Nielsen and The Nielsen Company, 2014).

The results obtained from the study further provided information regarding the concerns that were provided by the sample population which they faced about transitioning towards cashless economies. Seventy two percent of the respondents said that information security was their biggest concern regarding transitioning to a such an economy, South Africa is among the countries with the highest possible data breaches in the world, at more than 40% as compared to the other identified countries in the world (Ponemon Insititute and IBM Security, 2017). This high number can be associated with the fifty-six percent obtained where by the respondents said that they do not keep banking information in their mobile devices, this suggesting that the issue of security is one that needs a lot of attention before transitioning an economy towards it being completely cashless. Furthermore, the question regarding safety was posed as opposed to the overall concerns that were received, eight percent of the respondents mentioned that another one of their key concern was safety. The issues around safety lies in the fear that perpetrators could be fully aware that an individual could be carrying some sort of device or a card that contains much more money than if they carried physical cash, their safety could always be an issue.

As mentioned above, banks play a very important role in the implementation of cashless services. Without having a bank account, none of the population could be able to conduct cashless transactions, therefore it is vital and its importance is seen by all participants of this study having bank accounts. Large financial institutions as Banks play a very key role in implementing cashless economies. Banks act as enablers, money that the users have is usually stored in such financial institutions and in order to access this fund, users either make user of their cards or perform online transactins as mentinoed above. Ninety percent of the respondents in this study confirmed that banks will play a major role in transitioning towards a cashless economy, these banks are those that are to offer organizations Point of

Sale devices which will enable people to perform cashless transactions, furthermore ninety two percent of the respondents believe that governement should work along with Banks in order to provide small to medium organizations with Point of Sale Devices which will enable them to provide cashless services to their customers.

One of the most important question posed in the study was whether the participants were ready to transition towards a cashless economy. Sixty four percent of the respondents responded by claiming that they were ready to transition towards a cashless economy, while the remaining thirty six percent said they were not. The high positive response of participants who believe they're ready to have the economy become cashless has a direct link to the ownership of bank accounts, the high percentage of those that already purchase product online, the high frequency of online mobile and internet bank users.

What does this all mean? The adopting of cashless services in South Africa will in turn enable the economy to generate more revenue, which can be traced and tracked. This is can be of benefit to the economy as it has the potential to eliminate the possibility of the black market which robs the economy of a large amount of money. This implementation can increase the amount of money that can be achieved from all the income tax received from all the various channels which currently aren't being complying due to tax evasion. A greater amount of the sample stated their readiness to transition towards a cashless economy. The availability of the well technological banking infrastructure in South Africa, along with the greater population owning bank accounts and in position of banking cards, has the potential to drive the economy towards being cashless, this drive can also be facilitated by the ownership of mobile devices which also add as contributors of cashless services to the people.

10.   Recommendation for Further Research

The following recommendations can be put forward for related research in the cashless economy area.

- There is a need to explore a wider population than that from this study. The wider population should include a more participants of different age groups, more especially ages 0-17 and 60+. A wider research on participants of different races and much more distributed location than Gauteng.
- There is a need to explore how cashless economies can be integrated into rural areas that are extremely remote from any CBD.
- There is a need to explore how the government perceives the transition towards such technologies. Furthermore, it is important to understand whether the government is ready to facilitate the process towards implementing cashless services.
- It is important to assess the number of South Africans who do not make use of banking accounts in order to understand what challenges above those mentioned in the study, these people are probably facing.
- There is a need to explore the different policies, government and financial regulations that need to be developed and implemented for this framework to be fully functional in an economy.

11.   Conclusion

In conclusion, the results show that Transitioning South Africa towards a cashless economy is a process if undertaken, can be feasible especially during our current economic state. A greater majority of the respondents are educated and employed people, these are key drivers towards transitioning towards a cashless economy. Furthermore, everyone who completed the study provided feedback that they were all in position of bank account, mobile and cellular devices, these all constitute to the backbone of a cashless economy. These highlighted characteristics are all key drivers towards a cashless economy and of all South African respondents from the sample population, they can be quite representative of the larger population.

Although there were a number of concerns that the respondents provided, the overall feeling regarding transitioning to this new type of economy was positive. A considerable amount of the respondents believes that transitioning South Africa towards a cashless economy will indeed reduce the flow and amount of physical cash. This in turn serves as a positive component while trying to get rid of the black market. Secondly, this is also of value as the tax man can generate more income which subsequently which can be used for the overall growth and development of the economy.

There benefits of transitioning South Africa towards a Cashless economy as a developing country surpass the challenges and concerns that have been gathered from the sample population. Although the transition is one that will take time to implement. South Africa already has banks that have great technologies and services implemented and being offered to their customers. These technologies and services can serve as supportive structures of a cashless economy, thus indicating that the infrastructure is already in place for the transition

(FINMARK TRUST, 2017). Gathered from the respondents, it was clear from the data analysis conducted that South Africans show readiness for the transition towards a cashless economy. Irrespective of their concerns, several respondents showed their willingness to transition. To answer the question whether a cashless economy is likely to stimulate South Africa's economic development, the answer is yes. It was clear in the analysis that a cashless economy will stimulate the economic development of South Africa.

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E-education

Session Chair:

Tembisa Ngqondi

University of Mpumalanga, South Africa

A Practical Approach to Integrated ITG Practices at a South African University

Tembisa Ngqondi[0000-0003-3371-3659] and Hope Mauwa[0000-0003-3475-8859]

University of Mpumalanga, Mbombela Campus, Mbombela
thembisa.ngqondi@ump.ac.za, hope.mauwa@ump.ac.za

Abstract. The emergence of Information Technology Governance in higher education has emerged as significant for aligning information technology goals with that of institutions in order to achieve the mission and vision of the institutions. The emerging of information technology governance has brought an element of transformation on how technology is being embraced and used in both public and private sector. The literature confirms that institutions that have embraced Information Technology Governance practices are leading the industry in executing their business activities. Even though higher education institutions in South Africa have some form of Information Technology Governance or information technology strategic committee in place, they are still grappling to effectively operationalize their mandate to achieve their objectives. This article presents findings of a local university that has embraced acceptable Information Technology Governance practices, which demonstrates the integration of information and communication technology strategies into the institution strategies. The findings creates a basis for other institutions to learn and adopt the strategies used by the case studied. It further contributes towards the existing knowledge on Information Technology Governance in higher education.

Keywords: ITG, Strategic Alignment, IT, Institution of Higher Learning.

1 Introduction

The pervasive use of technology in private and public as well as in small and large institutions has created a critical dependency on information technology (IT) [1]. This in turn calls for effective strategies and infrastructure that align the IT goals with the institutional goals. Information Technology Governance (ITG) is a concept that has emerged to address the demand of aligning IT goals with institutional goals. ITG addresses the entire gamut of institutional demands/needs in its objectives since it focuses on a variety of institutional issues such as leadership, customer/client satisfaction, improved quality, lower costs, integrity and accountability [2]. In terms of higher education institutions (HEIs), the fusion of ITG strategies with university strategies (mission, vision and objectives) has been identified as an effective vehicle in enabling the institutions of higher learning to deliver acceptable, cost effective, and reliable teaching and learning [3].

Management in higher education (HE) are inclined to ITG with much interest to enhance decision making on complex IT issues affecting university governance and operations. However, there are some considerations emerging as challenges on how to effectively work within an academic culture of inclusiveness and shared decision-making while effectively and efficiently aligning the existing IT structure with the institution [4,5]. A study by Johl et. al in [6] in 2013 on ITG process maturity levels in South African public HEIs found that the overall level of ITG process maturity is low, and that the current levels of ITG process maturity do not relate to the critical role that IT plays in the HE sector. Consequently, interventions addressing specific issues are needed in order to ensure that HEIs in South Africa improve their ITG processes. This study seeks to establish a basis for developing an ITG model by analyzing the ITG approach adopted by Stellenbosch University (SU), which is one of the well-established universities in South Africa in terms of having a strong ICT infrastructure [7].

Literature on ITG emphasizes the roles and responsibilities of leadership in establishing effective ITG for an institution [8-10]. However, the investigation for this study provides a new approach in terms of ITG's strategic alignment of IT goals with institutional goals. This is as a result of the fusion of institutional and IT goals being investigated at different levels in the higher education institution (HEI), ranging from the operational level (departmental level) to the top level (executive level). The approach is specific to academic institutions of higher learning due to the unique nature of their structure.

The rest of the article is structured as follows: Section 2 provides a general literature review on ITG; Section 3 discusses the methodology followed during the study; Section 4 presents the findings; Section 5 highlights the contributions and recommendations of the study, and; Section 6 concludes the paper.

2 Literature Review

The literature review is divided into three subsections: ITG overview, which discusses ITG in organizations in general; ITG strategic alignment, which discusses benefits of aligning IT operations with organisation's enterprise operations, and finally, ITG best-practice frameworks, which discusses some of the ITG best-practice frameworks available on the market that can be used to guide an institution in establishing effective ITG.

2.1 ITG Overview

ITG is a broad concept, which is defined by various authors based on their specific areas of interest. This paper has based its definition on the ITG Institute definition in [8]: "ITG is the responsibility of the board of directors and executive management. It is an integral part of enterprise governance and consists of leadership, institutional structures and processes that sustains and extends the institution's strategies and objectives." It is a mixture of structures, processes and relational mechanisms that enables the effective implementation of institution's IT strategic alignment, especially at the level of senior management.

The concept of IT and ITG is not limited to a specific type of business, but has penetrated businesses of almost all kinds, ranging from small to large enterprises in both the public and private domains. ITG is a public and private sector issue though its focus has been more on the private sector [11]. It covers the culture, organisation policies and practices that provide oversight and transparency and is part of the wider corporate governance with a specific focus [12]. ITG processes and structures are there to ensure that an organisation's IT sustains and extends the organisational strategies and objectives.

2.2 ITG Strategic Alignment

Strategic alignment deals with the alignment of IT operations with current enterprise operations and the ability to build capabilities necessary to deliver business value. ITG allows for strategic alignment, which provides an excellent vehicle for understanding and improving the business-IT relationship [13]. The strategic alignment domain includes understanding the business needs, developing IT strategy, determining resource allocation, managing resource demand requests, and facilitating communication between business and IT [14, 15]. The full active involvement at many levels and in many activities within the enterprise and proactive and focused management are required in order to align ITG with the overall strategy of the enterprise [16]. It constitutes a continuous effort that requires world-class expertise (either in-house or outsourced) and strong demonstrable governance [16]. The identification of high level strategies and high level expertise in an institution is indeed the role of the senior management of the institution. This is reflected in most literature on ITG and strategic alignment [16-18]. The importance of participation on the part of management is further supported by the definition of ITG in [8] as an executive management responsibility.

The literature focuses closely on ITG and strategic alignment as a senior executive responsibility. However, this paper extends the focus to the significant contributions/roles that the majority of university stakeholders can make/play in establishing ITG platforms driven by the university community. The best ITG practices enable effective execution of ITG and strategic alignment within the entire university community.

2.3 ITG Best-Practice Frameworks

ITG best-practice frameworks are the key control models that can be used to assist an institution in achieving effective ITG. Effective ITG is the single most important predictor of the value an institution generates from IT [19]. Effective ITG is therefore achieved through embracing and using the ITG best-practice frameworks. There are different ITG best-practice frameworks on the market that can be used to guide an institution in establishing effective ITG. **An institution can adopt more than one model for effective implementation of ITG. This should result in successful and more organised activities that address the institution's mission and vision.** Some of the ITG best-practice frameworks are discussed in this subsection.

Control Objectives for Information and Related Technology (COBIT). COBIT is designed to help management in their ITG endeavours in understanding and managing of the risks and benefits associated with information and related technology [20]. COBIT creates the link between the business objectives and the specific IT and IT management tasks through statements about the control objectives [20]. It helps organization to meet business challenges in the area of regulatory compliance and risk management.

COBIT has been under continuous update with the latest iteration of the framework, COBIT 5, released in 2012. COBIT 5 [21] is based on five principles that are essential for the effective management and governance of enterprise IT: 1) Meeting stakeholder needs, 2) Covering the enterprise end-to-end, 3) Applying a single, integrated framework, 4) Enabling a holistic approach and 5) Separating governance from management [22]. These five principles enable an organisation to build a holistic framework for the governance and management of IT that is built on the following seven 'enablers': 1) People, policies and frameworks, 2) Processes, 3) Organisational structures, 4) Culture, ethics and behaviour, 5) Information, 7) Services, infrastructure and applications and 7) People, skills and competencies. Together, the principles and enablers allow an organisation to align its IT investments with its objectives to realise the value of those investments [23].

Information Technology Infrastructure Library (ITIL). ITIL was introduced and distributed by the United Kingdom's former Central Computer and Telecommunications Agency (CCTA) to provide a framework for good practices to guide the management of IT services. ITIL has been going under revisions and updates since it was introduced. ITIL 2011 is the current edition.

ITIL consists of an inter-related set of best practices for lowering the cost, while improving the quality of IT services delivered to users [20]. ITIL is organized around five key areas; business perspective, application management, service delivery, service support, and infrastructure management. There is no specific ITIL module dedicated to security management although it addresses that by reference to other modules or through a culmination of other processes [20].

ISO/IEC 38500. ISO/IEC 38500 is an international standard for corporate governance of IT published by the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC). It provides a framework for effective governance of IT to assist management to understand and fulfill its legal, regulatory, and ethical obligations in respect of the organization's use of IT.

Since its introduction in 2005, the standard has been going through updates with the latest update being ISO/IEC 38500: 2015. ISO/IEC 38500:2015 provides guiding principles for members of governing bodies of organizations on the effective, efficient, and acceptable use of information technology (IT) within their organizations [24]. The purpose of ISO/IEC 38500:20015 is to promote effective, efficient, and acceptable use of IT in all organizations by assuring stakeholders that, if the principles and practices proposed by the standard are followed, they can have confidence in the organization's governance of IT, informing and guiding governing bodies in governing the use of IT in their organization and establishing a vocabulary for the governance of IT [24]. The standard is applicable to all organizations from the smallest to the largest, including public and private companies, government entities, and not-for-profit organizations [24].

King Report on Corporate Governance. The King Report on Corporate Governance is a governance compliance document for the governance structures and operation of companies in South Africa. It is issued by the King Committee on Corporate Governance.

So far, three updates have been released since its first issue in 1994 (King I); 2002 (King II), 2009 (King III) and a fourth revision (King IV) in 2016. King IV report sets out the philosophy, principles, practices and outcomes, which serve as the benchmark for corporate governance in South Africa [25]. It builds on King III to bring it up to date with international governance codes and best practice and to take account of specific corporate governance developments in relation to effective governing bodies, increased compliance requirements, new governance structures, emerging risks and opportunities from new technologies and new reporting and disclosure requirements [26]. It contains 17 principles in total; 16 principles applicable to all organisations and 1 principle applicable to institutional investors. There are 208 recommended practices against the 16 principles, and for the 17th principle applicable to institutional investors, there are an additional 6 recommended practices [26].

3   Research Methodology

SU is a research intensive university, which is highly rated in research [27,28]. It also attracts national and international students due to the academic undergraduate and post graduate programmes it offers in various disciplines. Its IT systems and infrastructure are coordinated under the umbrella of the "e-Campus" initiative [29].

The study was carried out over two months. The first month was spent on analyzing documents that were sourced online and discussions were done through Skype and via email. The second month was spent on site (SU campus), where interviews were conducted and observations were made. The research structure that guided data collection and analysis follows.

3.1 Study Participants

A purposive sample of 12 participants was selected from the university population. The selection of participants was based on the findings from a briefing session and document analysis, and participants were selected from the different operational levels of the university. Since the study focus was on examining the effectiveness of integrating ITG with university practices and its challenges at the university, the participants were selected based on their active role(s)/participation in executing ITG processes. Table 1 represents the group of people who were interviewed.

Table 10. Study participants sample.

Participant/s	Number
Senior Director ICT	1
Director ICT Development	1
Director Center for Teaching and Learning	1
Director Library	1
Director-ICT Technical	1
Registrar	1
Managers of Facilities	2
ICT Faculty Managers	2
ICT Support Staff Managers	2
Total number of participants	12

3.2 Methodological Orientation of the Research

The study focused on collecting data from different sources using a qualitative approach. The interpretive qualitative method is based on hermeneutic philosophy because it supports the idea of collecting data in a space where the phenomenon under scrutiny has a relationship with everything else connected to the study [30,31]. This philosophy is well-suited to the study because it supports the research methods used in collecting data. The study has embraced a case study approach, i.e., a qualitative approach in which a case is explored over time through extensive data collection that involves multiple sources of evidence [32-34]. The study was carried out in three phases, combining different data collection methods: interviews, document analysis and observation. The order of the phases used for data collection are closely related to the different data collection methods used. The study, therefore, embraced a form of triangulation, whereby different investigatory approaches were used in collecting data. The data collection methods that were used are described next.

3.3 Data Gathering Techniques used

A descriptive approach was used in the first phase for learning about and understanding the university's ITG and other related components. The first phase consisted of document analysis and briefing sessions. Documents for analysis were sourced in different formats through: a) the Intranet, b) a request from the ICT Department Director and c) the Internet. The briefing sessions were organised and were presented in a workshop format. Document analysis provided data about university ITG policies and proposed ITG structures. The briefing sessions and document analysis provided a holistic picture of the university's organisational structure and reflected how ITG is positioned. This all helped outline the real life context of ITG at the university. The second phase embraced the explanatory usefulness of a case study. The purposive sample was identified after having acquired an understanding of the real life context of the university. The second phase collected data through interviews and observations. This was done to check if the ITG was implemented as intended or designed, and to identify problems experienced. It looked at the measures that were implemented and why they were implemented. Another reason why this was done was to identify the strengths and weaknesses of the use of ITG at the University. The

third phase mapped the findings with some of the best ITG best practices to test the credibility, viability and compliance with some of the national and international standards of ITG practices.

3.4 Data Collection and Analysis

Data was collected in the form of audio recordings and written field notes while practicing the different qualitative measures as described in Section 3 subsection 3.2. Data analysis was carried out using within-case analysis to analyse and interpret data and illustrate the state of ITG at the university. Within-case analysis embraces the thematic analysis approach, where common themes and meanings are obtained and coded into small chunks [35]. Themes, which were based on the five principles of COBIT 5 [21], were coded through a systematic process of data analysis. The transcribed interviews were studied and grouped into different categories that arose from common textual data. A summary of the themes investigated in the study are captured in Table 2.

Table 11. Themes investigated in the study.

Number	Theme
1	ICT strategies
2	ICT strengths and challenges
3	Aligning IT goals to the university goals
4	ICT infrastructure and personnel
5	ITG

4 Findings

The participants were probed on whether the university has adopted ITG and whether it have been aligned to university strategic plans. Participants who are senior managers indicated that the university's adopted ITG approach is based on the King III Report because the focus of the university is more on instilling a culture of compliance to integrative reporting and be responsive and accountable to university stakeholders.

The model shown in Fig. 1 represents the different elements that are combined to create the ITG structure of the university. The Rector's management team is the highest leadership team in the university structure that oversees the effective alignment of IT and institutional goals. ITG activities that aim to help the university achieve its mission are divided into different categories/assigned to different entities such as IT strategy and governance, projects and priorities, information governance, and technology and operations. These areas are championed by different committees with high level expertise. Internal and cross-institutional committees and working groups also form part of the overall SU ITG structure. The facilities department at SU employs full-time qualified ICT personnel who work closely with the central ICT Department of the university. Since facilities is responsible for the security of the university, the ICT person in facilities takes full charge of identifying special ICT security needs and, thereafter, submits them to the internal ICT Department for the installation of the specialised ICT security equipment. Services are outsourced only when there is no internal expertise available.
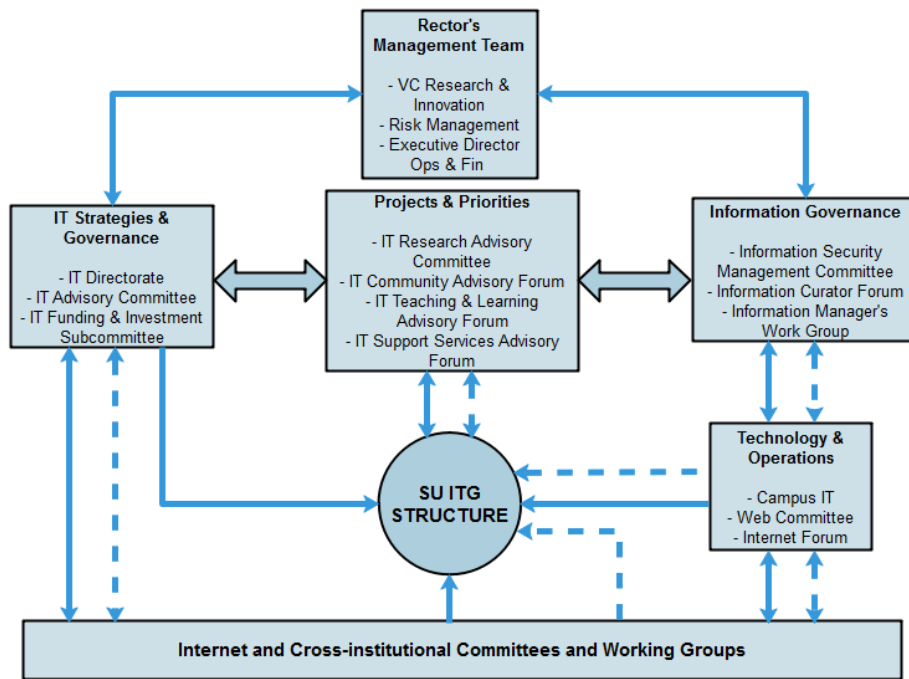
Fig. 6. The Current ITG Model at SU

Participants also indicated some strengths and challenges of adopting the ITG at the institution. The major strengths/advantages of adopting ITG at the university is that ITG planning and implementation is supported and championed by the most senior leadership. It has emerged that the rectorate participates in the IT Advisory Committee (ITAC), where other relevant executives and chief directors, deans and managers meet once per semester to guide the IT strategy of the university. IT strategies and governance entities ensure that IT is aligned with institutional strategies, complies with best standards, and is integrated into institutional decision-making. The ITAC resolve institutional IT investment and project priority impasses referred to them from the IT Directorate and Advisory Forums. It also advises on IT investments (renewals, infrastructure, and growth), IT funding sources, and on models for projects and operations. It furthermore recommends actions to secure the continued financial sustainability of the IT Division, and aggregates financial implications of projects.

It has also emerged that there is projects and priorities entity that ensures that IT's portfolio of services, projects and investments is aligned with the requirements of research and postgraduate studies, teaching and learning, community interaction and support services. The information governance entity communicates Information Security responsibilities. It appoints responsible people in Information Security roles across the institution. It also reviews and approves Information Security Regulations, coordinating cross-institutional problem-solving around data quality issues. It determines subsidiary policies and regulations developed in terms of the Information Security Regulations, supplies an annual Information Security Plan, oversees curatorship and accountability and determines information management priorities.

The technology and operations entity aligns ICT projects, investments, and budgets with areas outside the direct control of the IT division. With the IT division, it establishes information ownership, governs and co-ordinates the coherent provision of ICT services campus-wide. Furthermore, it ensures the sustainability and relevance of technology for the institution over time.

The internal and cross-institutional committees and working groups are established/sourced from various internal and external divisions of the university and these ensure that IT's portfolio of services and investments is aligned with the financial, Human Resources, and alumni systems requirements of the university.

The interaction and flow of information between these entities is not rigid but mainly cyclical, whereby decisions from one entity can pass through another entity to be endorsed and finalised. Membership of the committees is sourced at high levels of management at the university and the IT unit is represented on all committees and working groups of the university. Although it is said that the ITG Model at SU was developed based on King III Report, their model is also supported by some of Luftman's key IT-business alignment principles in [13]. Luftman in [13] indicates that (i) the key to the strategic alignment maturity of an institution is to align IT with other functional sections in the institution by focusing on activities that achieve overarching and cohesive goals, (ii) alignment should address how IT might operate in harmony with the business of the institution, and how the institution should, or could be in harmony with IT, (iii) the alignment of IT with the institution's business should evolve into a relationship where IT and other institution units function and adopt

strategies together and (iv) IT must receive strong support from senior leadership , be the subject of good working relationships and capable leadership. The current state of ITG at SU seems to be strong at the strategic level (the rector's team) and management level (directors and senior managers) in line with the fourth ITG strategic alignment principle identified by Luftman in [14].

Communication has been identified as a major challenge at SU, especially at an operational level; ICT users within the University tend to ignore messages and generally, they do not respond to requests when input is sourced from them. This is represented by the dotted lines in Figure 1. The other challenge at the operational level is the inconsistency in establishing ITG forums to define the academic-related IT needs of different faculties. Challenges presented themselves in the findings taken from the interviews. Nine out of twelve candidates interviewed confirmed that communication is a big challenge and that some faculties do not have departmental forums that address academic-related technology needs. Table 3 presents a summary of interview findings according to the themes investigated in Table 2.

Table 12. Summary of interviews findings based on investigated themes

Theme	Presentation of findings	Comments
ICT Strategies	Regarding IT Strategies at SU, IT is centralised in the ICT Department but also partly decentralised within different departments through IT activities that support their specific needs. Some decentralised IT activities occur in the library, faculties, admissions office and other facilities.	The strategic design of the IT structure at SU is effective in the sense that one unit is not overburdened by key IT activities. Forums supporting the execution of the ITG Model support the broader university structure.
ICT Strengths and challenges		• Involvement of the senior management of the university makes the execution of IT processes in the university easier provided they always participate in all IT-related projects at the university. • Budgets and financial policy accommodate different units based on their special needs. • Communication is a challenge in that people at the operational level and some in the middle level management experience along with those who are not directly participating in the ITG structures of the university. • Lack of guidance in terms of establishing ITG forums at the operational level can lead to non-uniformity between structures which can lead to delays technological activities.
Aligning IT goals to the university goals	• IT goals are directly linked to the university's goals because all IT projects that are developed in the units are based on the university's mission and vision. • Special IT projects are only supported by the IT Strategic committee if they have a component that talks to the university's objectives. • IT projects proposed by different units are discussed and evaluated within the ICT	• The concept of ITG should be a theme at the university championed by the highest strategic leadership of the university; hence all IT projects should be strictly aligned with the university's mission and vision. • The university's policy to fund IT-related projects strictly indicate that these must be in line with the university's objectives.

	Forums before they are implemented. The forums evaluate their relevance and value in terms of the university's goals.	
ICT infrastructure and Personnel Resources	• The university consists of the structured ICT forums at different levels in the organisational hierarchy; these advise on IT activities and decides on IT infrastructure in achieving the university mandate. • The units responsible for handling IT activities of the university cover at least 70%-85% of the personnel at the university. • IT Strategy at the university is financially supported by the university's overall funding and also by other means of funding; infrastructural resources are in a good shape.	• University computers are replaced after every four and half years. • The funding of IT projects is based on internal funding from the IT division, but, if there are not adequate funds, earmarked funding comes from a strategic project or it can be funded from an external division.
ITG	• The university has different IT Forums that look at the different needs of the university in terms of IT structure. • Each forum has terms of reference that assist it in executing its mandate effectively.	• The ITG forum structure and its committees are represented at all levels of the organisational structure. • The mandate of these forums does not conflict because they are guided by the terms of references specific to the mandate of each forum as well as overall strategic IT planning.

5   Contribution and Recommendations

This paper has made three notable contributions. Firstly, the findings and recommendations can be used as a guide to possible ITG implementation in HEIs. Secondly, the work has identified possibilities for strengthening ITG at SU; an example of ITG that can be adopted by other universities. Thirdly, the work serves to raise awareness among universities that do not have ITG in place.

ITG at SU is foremost a strategic concept, which is managed and supported by the leadership of the university. The system in place fulfils the definitions of ITG as set out by different ITG researchers. Introducing ITG as a concept to the senior leadership of an HEI can be a challenge due to its complex nature/structure. Like corporate industry, the strategic execution of university activities and mandates is also executed at the operational level, meaning expertise resides in individual units. This can hinder the progress of executing an ITG model, especially when it does not have input from the operational level. Institutions with effective ITG usually implement ITG strategies at multiple levels including at a strategic level, where senior leadership (board) is involved, within the management echelon, and at the operational IT and business management levels [36]. Although the operational level was identified as an important layer for ITG processes at any institution in [36], ITG literature emphasizes ITG at a board level in many instances. Further research may prove necessary to discover how including the operations level in developing ITG models at institutions of higher learning can effectively improve the execution of IT-institution alignment and thereby the achievement of that institution's vision and mission. Adopting other best practices defined in Section II in developing university ITG models can further improve current models because practice should always inform and be used to adapt models.

6   Conclusion

This paper investigated how ITG practices are embraced and integrated at SU, an academic institution of higher learning. It reveals that ITG is high on the agenda of the university. At SU a mixture of structures, processes and relational mechanisms enables the effective implementation of IT institution strategic alignment, especially at the level of the rectorate and senior management. The commitment, support and participation of senior leadership in establishing and executing an ITG model at the university has contributed positively towards doing so. However, the lack of participation of stakeholders at the operational level has created a gap in communication and needs that have been addressed, hence the model is not highly rated amongst these stakeholders. Using a single ITG best practice, i.e., the King III Report, when deciding on best practices, has also limited the establishment of a model that would be highly rated by all interviewees.

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Community Development

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Emma Coleman

University of the Witwatersrand, South Africa

Social Inclusion in the South African Information Systems Academic Community

Emma Coleman[1][0000-0002-2570-1140] and Yao Ameyaw-gyarko[2]

[1, 2] University of the Witwatersrand, 1 Jan Smuts Avenue, Johannesburg, South Africa
emma.coleman@wits.ac.za

Abstract. This paper argues that understanding and addressing the barriers to inclusion in the South African Information Systems academic community will foster greater understanding of locally relevant issues through increased research output and collaboration. A mixed-methods survey of SA IS academics was carried out in order to understand perceptions of inclusion and exclusion, and the social biases and structural barriers that may prevent academics' full participation in the SA IS community. Results showed that social biases exist in relation to race and academic rank (and reputation) and the core structural barriers are both institutional and economic in terms of funding and cost of conference attendance and registration. Cultural barriers also exist in terms of language and the perception of a clique or 'in-group' of IS academics. Receiving communications about events, conferences and journals promoted feelings of inclusion in the academic community. However, without the ability to participate in these events due to structural barriers, academics are not able to reap the benefits of inclusion such as building networks, obtaining feedback on research, and developing collaborative work. Thus, the structural barriers to participation prevent full social inclusion in terms of full participation in the activities of the community. This paper contributes to the IS literature by suggesting four structural barriers to consider when researching inclusion and exclusion, and demonstrating the importance of looking beyond behaviours based on social biases to core elements of the social structure that may prevent full participation for those who wish to participate.

Keywords: Social Inclusion, Information Systems, Academia.

1   Introduction

South Africa has one of the highest levels of inequality in the world (Mangaliso & Mangaliso, 2013). There is a need for greater social inclusion so that all citizens have the opportunity to participate freely in the activities of society, and to live the life that they choose to lead. South African academics my not be immune to the struggles that exist in the broader SA context and this may mean that there is a need for more social inclusion within the IS academic community. However, we do not know academics' experiences of inclusion or exclusion in this specific context.

People may be socially excluded from full participation in academic activities for many reasons such as race, gender or sexual orientation, or because of such aspects as socio-economic status, or even research interests and methodology (Trauth, 2017; SIG Social Inclusion Task Force, 2017). However, it is not just social biases based on individual characteristics that result in exclusion. Structural barriers also prevent academics' full participation in academic activities.

This research explores academics' perspectives regarding social inclusion and exclusion in the SA IS academic community and academics' perceptions of social biases and structural barriers to inclusion. There is little existing literature on social inclusion focussing on South Africa, particularly in the academic context. As such, we do not know if people in the local IS academic community are feeling excluded, why, and what the barriers are to fostering greater inclusion within the community. Not everyone may have the opportunity to participate fully in the community. Zheng and Walsham (2008) suggest using Sen's (1993) capability approach to understand social inclusion. In brief, this perspective suggests that when people are prevented from fully participating in the communities in which they are members, their capability to live the kind of lives they value is diminished. A capability is the ability to achieve something, and can be viewed from a 'well-being' perspective and an 'agency' perspective. Here, exclusion is capability deprivation, and development is capability expansion. It is the capability deprivation definition of exclusion that this paper follows as its theoretical lens. As such, we can ask, when IS academics in South Africa are unable to fully participate in IS community activities, how does this affect their capabilities as scholars? Understanding what scholarly capabilities are diminished, and putting strategies in place to foster an inclusive IS community will benefit those concerned and the community as a whole. A strengthened SA IS community can help make a better world, and improve the quality of life of individuals in many societies locally and globally.

The area of social inclusion and the need to encourage work in developing countries has been an increasing topic of conversation during recent IS conferences; there is a subtle shift towards more research regarding social level phenomena, and there are calls for research into 'making a better world with ICT' (Walsham 2012, Sahay 2016). Trauth (2017) in her 'Research Agenda for Social Inclusion in Information Systems' states that "social inclusion in the information systems field is a research topic whose time has come" (2017:17) and that we "have to make sure that research organizations are socially inclusive. The sentiment that the 'time has come' for the topic is also reflected in the Association for Information Systems' (AIS) increased commitment to Diversity and Inclusion (D&I) through setting up a new D&I committee and recently accepting the committee's D&I statement as the statement that will extoll the D&I values of the AIS as a professional body.

Sen's capability approach lends itself to subjectivity to see if the person really does feel socially excluded or not. A person may not feel socially excluded because they may feel like they capabilities are not being deprived and they are living the life they want to live, a life with "real freedom" (Robeyns, 2003). Capabilities are properties of individuals and not a community. Hence, the capability approach is an ethically (or normatively) individualistic theory (Robeyns, 2003).

Social exclusion has been defined by Levitas *et al.* (2007) as "The lack or denial of resources, rights, goods and services, and the inability to participate in the normal relationships and activities, available to the majority of people in a society, whether in economic, social, cultural or political arenas. It affects both the quality of life of individuals and the equity and cohesion of society as a whole" (Levitas et al., 2007: 9)

The above definition highlights barriers to participation in the normal activities that are available to the majority, but it also addresses the cohesion of a society. This is important as it suggests that more social inclusion could result in a better society for all, in this this case, in terms of the academic community.

Silver (2007) conceptualizes social exclusion (or marginalization) as "detaching groups and individuals from social relations and institutions and preventing them from full participation in the normal, normatively prescribed activities of the society in which they live". As the converse, social inclusion focuses on enabling groups and individuals to participate fully in such activities. Fostering greater inclusion in terms of, for example, networking, conference attendance and greater publication opportunities, means that we can all benefit from this work, and strengthen the capacity of local researchers to carry out sound, rigorous research that will contribute to making a better world. Each definition above focusses on individuals not being able to fully participate in the normal activities of the community of which they are part. However, Sen (1993) goes beyond this to consider how this affects people from living the kind of life that they value. In each case, quality of life is diminished, but also community cohesion and hence potentially sustainability of the community. More cohesive communities have higher levels of trust, meaning they are also more public spirited and better able to act for the common good, therefore increasing sustainability of the community (Wilkinson, Pickett and De Vogli, 2010).

Trauth and Quesenberry (2006) recognised that social exclusion is not only related to inequalities in demographics and social-economic status but also deep-seated issues of political and institutional arrangements, as well as discrepancies between traditional norms of social life across cultures. As such, this paper looks at social biases related to differences in individual characteristics and barriers to inclusion related to aspects of the social structure.

2   Social Exclusion

In order to understand the true extent of social exclusion it is important to understand the different distinctions of social exclusion. Active and passive social exclusion exist. Active exclusion means that a person or group of people are excluded because of something being deliberately done to them (Sen, 2000). Sen used the example of immigrants and refugees not being given a political status. This is active exclusion because the refusal to be given a political status is something that was explicitly done to them.

However, exclusion can also be passive, this occurs when deprivation happens due to a social process which did not deliberately attempt to exclude (Sen, 2000). Sen used the example of the deprivation that minorities suffer in the various countries that they live in, for example through not knowing the language or the culture. Since with this type of exclusion it is evident that was no deliberate act to exclude the minority it is called passive exclusion. If exclusion does exist in the IS South African academic community, it may not be due to a deliberate attempt to exclude anyone, but rather as a result of structural barriers and social behaviours based on unconscious biases that have become norms in our community, and which the majority are not aware of. Thus, it is important to raise awareness of social behaviours and structural barriers that may potentially exclude without our knowledge or intention (i.e. passive exclusion).

Trauth et al. (2012) suggest that gender and ethnicity stereotypes hinder growth in the Information Systems workplace. According to Trauth (2017), in academia social exclusion could occur due to age, disability, ethnicity, gender identity, nationality, race, religion and sexual orientation and academic rank. However, the AIS

SIG Social Inclusion Task Force have recently found that inclusion issues in the AIS relate more to non-demographic factors such as social capital, discipline/area, academic rank and country or type of employment. However, these core issues may be related to demographics, for example regarding the evidence that there are more male academics holding higher academic ranks in Information Systems such as full professor, than there are female academics (Loiacono *et al.*, 2013). This would then have a knock on effect on exclusion based on academic rank. These issues are not prevalent only in Information Systems, and there is a known issue with gender equality in academia, particularly in STEM fields (Riegle-Crumb *et al.,* 2012).

In their study of women in New Zealand Universities, Airini *et al.* (2011) stated that collegial relationships with seniors, collegial relationships with peers; and bullying or unsupportive colleagues affect the advancement of women in academia. Airini *et al.* (2011) suggest that invisible rules exist regarding how things are done. An example of this could be whereby it is evident that a person advances quicker in the ranks if they attend specific conference. Airini *et al* (2011) defined proactivity as "when women have undertaken a predetermined course of conduct with a view to advancement". An example could be promotion coming from increased publications, or conference attendance leading to greater collaborations and sharing of ideas. However, not all academics may be aware of, or told, these invisible rules, and those that are aware of them may not be afforded the resources to be proactive due to institutional or structural barriers. Thus, those who can attend can get promoted and those that cannot attend conferences or publish are nor promoted because of these barriers. An example could be young black females who repeatedly teach 1000 first year students in historically black or teaching universities, who may never have the time nor support in terms of skills training and feedback for writing academic papers. As reviewers for conference and journals, we are the first-line in support for young academics who may not have a publication record, and as such it is our responsibility to give constructive and supportive feedback, something which the South African Computer Journal, for example, strives to engender in its editors and reviewers (Machanick, personal communication).

3   Theoretical Lens

The theoretical lens for this paper focuses on Sen's idea of capability depravation and the inability to participate in the normal activities of the community, but importantly, we view that it is only those who wish to participate in the community, or would wish to participate if they were aware of the activities, who are being excluded. This is because it is only these people who are unable to lead the lives that they personally value.

We consider the reasons for these depravations in terms of social biases and structural barriers, as mentioned above. The social biases relate to individual characteristics, and there are four categories of structural barriers.

Kagee *et al.* (2011) outline four structural barriers that exist in the context of resource-constrained settings like South Africa. These are economic, institutional, political and cultural barriers. These structural barriers are adapted from the South African health-care context studied by Kegee *et al.* (2011). These barriers were considered appropriate as they encompass the economic, cultural and political arenas of Levitas et al. (2007) (with their 'social' arena being covered by the social biases), and the 'political and institutional arrangements' of Trauth and Quesenberry (2006).

In academia, structural barriers could relate to such issues as lack of money in the university, the location of the university or the image that the university has in terms of reputation and in terms of their prioritisation or focus on research output. Economic barriers in the SA academic context could relate to socio-economic factors of individual academics, or such things as issues of exchange rates preventing travel to conferences in other countries. Institutional barriers in the academic context could be organisational structure of the department or university, organisational support (time to participate, finance etc.) and organisational policies. Political barriers could relate to opinions expressed in research papers, or power-politics issues between academics. Cultural barriers could relate to contrasting norms, values and beliefs between an individual academic, or academic department or institute, and that of the SA IS community as a whole, or to the research culture of the university. This would include any stereotypes in terms of demographics and personal life choices.

4   Research Methods

This paper follows the critical research paradigm given its aim to create knowledge through raising awareness and to give a voice to marginalised groups and individuals (Cecez-Kecmanovic, 2007). This research carried out a mixed-methods survey using qualitative analysis of perceived social inclusion and exclusion amongst SA IS academics, supplemented by quantitative data collection and analysis through the use of simple percentage statistics. Qualitative analysis could then be used to explain the reasons behind the quantified perceptions of

inclusion and exclusion. The survey, comprised of open ended and closed questions, was sent out to a sample of approximately 600 IS academics in South Africa, both directly through several mailing lists, and via HoD's in university IS departments.

The initial questions were demographic, followed by a question on perceptions of personal exclusion based on demographics. Levels of involvement in the academic community were measured through asking about previous and future planned South African journal and conference submissions, and any barriers to submission or attendance. There followed a section addressing perceptions of exclusion based on the four structural barriers of political, cultural, economic and institutional reasons, with space to elaborate qualitatively on the reasons for these perceptions. The survey concluded with a request for suggestions to improve inclusion in the SA IS academic community.

Forty-one responses were received, which is below the expected response rate. This may indicate that there is a low perception of exclusion from those sampled, either because there is little problem with exclusion, or because those who are excluded could not be reached through the sampling method used. Future research will need to recruit respondents in a more direct way, through visiting universities which may be relatively disadvantaged within SA, and perhaps offering a paper-based questionnaire.

Thematic analysis was carried out based on the broad themes of perceptions of social inclusion and exclusion and reasons for exclusion. Reasons for exclusion were broken down into behaviours resulting from social biases and the four structural barriers identified from the literature.

5 Quantitative Results

5.1 Demographics

Twenty-five (67.57%) respondents identified as men and 12 (32.43%) as women. The remaining four IS academics did not respond to this question. Twenty respondents (55.56%) identified as white, nine (25%) as Black, three as (8.33%) Indian/Asian, two (5.56%) as coloureds and two as "other". Under other, they identified themselves as 'African' and 'South African'. Of the twenty white IS academics, eleven were men and eight were women. Of the nine Black African IS academics there were eight men and one woman. The fact that the majority of the respondents were white may generally reflect the demographics of the IS community in SA, or at least those who were involved enough to receive and respond to the survey, although we tried to be as wide reaching as possible in our data collection.

The two most popular academic positions were Full Professor and Lecturer with ten each. Six of the IS academics were Senior Lecturers. Four (12.12%) were Associate Professors, two were Doctoral students and one of them was a Post-Doctoral researcher.

Of the ten Full Professors and Lecturers, seven of them were men and three were women in both academic ranks. Two men and three women identified as Senior Lecturers. The two Doctoral Students are both men. Three Associate Professors identified as men and one as a woman. Of the ten Full Professors there were six whites, one African (other), one Indian/Asian, one coloured and one Black African. Of the ten Lecturers there were six whites, two Indians/Asians and two Black Africans.

5.2 Levels of Involvement

Levels of involvement were looked at in relation to conference and journal submissions. The South African Institute of Computer Scientists and Information Technologists (SAICSIT) Conference is the most popular Conference to attend with 24% of respondents saying that they have attended this conference in the last five years. The South African Computer Lecturers' Association (SACLA) Conference is the second most popular with 22% of respondents having attended the conference. The IDIA Conference is the third most popular with 11% of respondents having attended in the last five years. In terms of future planned attendance in the next five years, the two most popular remain the same being SAICSIT (27.5%) and SACLA (20%). The third most popular conference is African Conference of Information Systems and Technology (ACIST) with 11.25% respondents saying they plan to attend this conference, with IDIA having dropped to only 3.75% planned future attendance.

In terms of journal submissions in the last five years, The South African Computer Journal and South African Journal of Information Management are the most popular (both 22.5%). The African Journal of Information Systems and Electronic Journal of Information Systems in Developing Countries were the next most popular (both with 17.50%). The results remain largely the same for planned journal submissions over the next five years, the most popular being South African Computer Journal with 27.27% of respondents affirming their

intention to submit, followed by The Electronic Journal of Information Systems in Developing Countries (22%), South African Journal of Information Management (18%) and African Journal of Information Systems (14.5%).

It is very difficult to assess if a person feels excluded purely based on the fact they do not submit to journals or attend conferences. The opposite is also true, it is very difficult to say a person feels included just because they attend conferences and submit to journals. Using Sen's Capability Approach, we must consider the individual in terms of his or her own personal aims, goals and desires. Thus, level of involvement does not relate directly to feelings of inclusion in terms of the definition of social exclusion regarding having the freedom to fully participate in the community's activities. However, low levels of involvement may indicate some form of capability depravation which, if addressed, could enable more involvement for those who wish to be involved. Hence, participants were asked directly about their feelings of inclusion and exclusion, and reasons for such.

5.3 Perceptions of Inclusion and Exclusion

The majority of participants felt included or somewhat included. However, some were undecided, and others did feel that they were excluded. It is promising that the majority of respondents felt included. However, it is not clear whether this is a reflection of the sampling method used.

The respondents who stated in this question that they felt excluded in one way or another tended to voice their opinion quite strongly in the qualitative open-ended questions as compared to those who did not. These were the respondents who felt excluded from partaking in the community like everyone else. However, even the undecided respondents provided interesting and important contributions to this study.

None of the respondents felt excluded due to religion and sexual orientation. This reflects the findings of the AIS SIG Social Inclusion Task Force (2017) survey, which found that the least common attributes related to perceived exclusion were sexual orientation, religion and disability.

The most popular reason for feeling excluded was academic rank with 8% of respondents saying they felt very excluded because of this reason and 19% saying they felt somewhat excluded because of this reason. This also reflects the findings of the AIS SIG Social Inclusion Task Force (2017) survey. Ethnicity, race, nationality and place of employment were also notable reasons for exclusion.

5.4 Structural Barriers to Inclusion

Twenty-five respondents felt excluded from the South African IS community for institutional reasons, with eight (32%) saying they felt excluded while two (8%) said they felt somewhat excluded due to institutional reasons. This was the most popular reason for exclusion in the survey. Three (12%) IS academics said they felt excluded while five (20%) felt somewhat excluded due to economic reasons.

Political reasons were the least popular reason for exclusion with only one person feeling excluded because of that reason. However, this may relate to the fact that this was not defined in the survey and thus, internal power-politics issues were not discussed. Cultural reasons was also not a popular reason for exclusion but still yielded qualitative comments. Only two (8%) felt excluded and three (12%) felt somewhat excluded because of cultural reasons. Again, the possibility of commenting on organisational culture was not stated in the survey. Future research regarding structural barriers may benefit from carrying out interviews, where different aspects of each barrier can be probed more deeply.

6 Qualitative Results

The qualitative results are structured in terms of perceptions of inclusion, perceptions of exclusion, structural barriers to inclusion, and suggestions for increasing inclusion.

6.1 Perception of Inclusion

The perception of social inclusion in the SA IS academic community is that the community is inclusive, which is mainly due to people being aware of the events and journals that exist. *"Awareness of events, conferences, calls for papers, etc., via email distribution lists"* (respondent 35). This awareness is due to communication. Communication can come in many forms; it can be a formal email or informal communication like conversations at conferences. Almost everyone who is part of the distribution list which was used for sampling respondents seemed to get the important information like calls for papers. This knowledge of events, conferences and calls for papers leads to a better likelihood of participation. It seems that through awareness and communication, many SA IS academics are able to participate in the normal activities of the community such as attending conferences and

submitting to the journals of their choice. Participation in events and conferences seems to be a good measure of social inclusion in the SA IS academic community. However, having networks with academics in other universities seems to also foster a perception of social inclusion. *"Participation in events and conferences; network of scholars at various SA universities."* (Respondent 11). The people with networks in various universities have a better chance of feeling included. Ironically, these networks are best made at these national conferences and events that are hosted, thus, lack of attendance (for whatever reason) may foster a viscous circle of exclusion.

6.2   Perceptions of Exclusion

The results relating to social exclusion can be perceived as active exclusion (purposeful and deliberate exclusion) or passive exclusion (due to a social norm or structural barrier without intending to exclude). However, it is not always clear which form of exclusion is actually taking place.

One perception is that social exclusion exists because some IS academics do not know when conference submission deadlines are, or even are not aware of the existence of some journals. *"Not enough communication to people in the profession to know about their existence"* (Respondent 32). This comment was given as a barrier to journal submission. This lack of awareness likely stems from a lack of communication, thus the two are connected. This respondent was clearly uninformed about the activities and resources of the SA IS academic community. *"I just got my PhD degree in IS and I was not aware of all these developments until recently after I lost my job at the university and I was told that I can get to know about new positions if I join SAICSIT"* (Respondent 32). This may indicate institutional barriers to communication and awareness, i.e. passive exclusion, or active exclusion of a particular individual. This also indicates a need to separate academic rank from academic qualification in the SA community. This respondent is a Senior Lecturer who recently completed their PhD. The South African academic context is in contrast to the expectations in the literature of a close mapping between academic rank and qualifications (and perhaps years of academic experience), and there are many experienced Lecturers and Senior Lecturers in South Africa who may be working towards Masters or PhD qualifications. However, the changing landscape of South African academia to require qualifications at certain ranks can lead to frustration *"Not getting a promotion because of lack of formal qualifications, even though I had held the post informally for a number of years"* (Respondent 5). Here, there is a perception of exclusion because of the changing academic landscape in relation to the history of academia in SA, where promotions could be achieved without a PhD for example.

"In my opinion, I think there is an attitude problem amongst IS academics whether it is ranking of the individuals (e.g. professors) in the workplace, papers published (number and where it's published), or institution where employed (reputation of the institution). I find IS academics being critical of other academics' articles even though it is published. In my opinion, this attitude shapes the community to be very biased on who is included and excluded. I even see this judgemental behaviour come through in paper review comments." (Respondent 13). It seems like ranking is an aspect that shapes who is included and who is excluded, but reputation is also a factor, for example the number of papers published and the institution of employment. Thus, there are elements of the social structure that promote active exclusion.

Race was also associated with a perception of exclusion. *"The underlying theme of identity politics that seems to pervade some universities whereby the factors of white privilege and inherent racism are presumed. I have experienced the negative effects associated with attitudes informed by these factors at the institutional management and administrative level and not at the student level"* (Respondent 26). This comment demonstrates a relationship between institutional barriers and race regarding exclusion. It could also relate to political and cultural reasons. This would indicate exclusion as a social process (part of the social structure). Some respondents perceived a relationship between lack of communication and race as a deliberate attempt to exclude information from specific IS academics.

"The supervisors who are well aware of these opportunities kept this information about these developments to themselves maybe due to race or ethnicity" (Respondent 35).

This would be an example of active exclusion, whereas the majority of the structural barriers are more of a form of passive exclusion. Any active exclusion found related to the structural barriers relate to personal characteristics, specifically race and academic rank.

6.3   What Barriers to Social Inclusion Exist?

Based on Kagee, et al. (2011), structural barriers to exclusion were explored in terms of economic, institutional, political and cultural factors. Political factors were not found in this study and are therefore not addressed here. Barriers to level of involvement are addressed before covering the structural barriers.

Barriers to Conference Attendance. Funding seems to be a recurring theme with the respondents. This sub-theme occurred with many of the main barriers to inclusion.
"Financial related to university policy on funding" (Respondent 33)

As this largely relates to specific university or institutional policies, this relates to the theme of institutional barriers. It may also fall under the structural barrier of economic factors.

Time is also a barrier to conference attendance, both in terms of travel and time away from the office, and in terms of time for academic writing. This may relate to individual universities' workload requirements, and thus may relate to the theme of institutional barriers.
"Time to write a paper. The academic teaching load is unrealistic" (Respondent 3).

Both funding policies and having time to carry out research may relate to the university's focus on research versus teaching. The time factor also relates to the geographical issues identified as barriers.

"Important and relevant workshops are almost, always, concentrated in bigger cities, like Johannesburg, and Cape Town etc." (Respondent 35).

"Geography has been the only barrier that I have experienced and the choice of venues for conferences sometimes makes them difficult to attend given other personal commitments" (Respondent 23).

This shows that the location of the conferences can be a barrier both in terms of funding to attend and time to attend.

Competition also emerged as a barrier to attendance. Due to the large number of people that are in the Information Systems academic community there is a lot of competition. As shown in the quantitative results, there seem to be three to four very popular conferences to the respondents. With that in mind, there are many people submitting to the same conference, hence the stiff competition.
"Competition - getting papers accepted" (Respondent 3).

Administrative red tape also emerged as a barrier. This means that the institution/university makes it unnecessarily difficult to attend the conferences.

"Administrative red tape at my institution" (Respondent 11).

The bureaucracy required differs between institutions. Thus this theme relates to institutional structural barriers.

Barriers to Journal Submission. Similarly to conference submissions, respondents found the time required to prepare journal submissions difficult to meet.
"Time to do the research and submit" (Respondent 34).

The standard of work required also emerged as a barrier, particularly for more junior academics who may have not yet learned the necessary skills to know what is required of a journal paper. This, and the difficulty getting conference papers accepted, relates to the earlier comment regarding supporting junior academics to improve their academic writing.

"Perhaps the very high standard expected when academics are starting out" (Respondent 33).

Junior academics may struggle to be included in the community because they do not submit to or get accepted by journals and conferences. This may have a knock on effect of feeling excluded from those networks and collaborations that are developed through conference attendance. These collaborations also help with the skills required to understand journal requirements, and thus it is recommended that junior academics who are struggling in this area seek out collaborations wherever possible. It is also recommended that more senior academics seek out ways to support junior academics in building their network of academics in their research area. It is also recommended that junior academics seek out opportunities to review papers as this helps with understanding journal requirements, and that editors invite junior academics to review as one of the three reviewers of a paper (ensuring that they get to see the comments of the other reviewers to help with the learning process).

As mentioned, one of the core aspects of inclusion is awareness of opportunities to submit to conferences and journals, and conversely of course, lack of awareness can lead to not feeling included in the community. This is a barrier to conference and journal submission which respondents relate to communication.

Results of the AIS SIG Social Inclusion Task Force (2017) survey showed academics' feelings of exclusion due to research area or methodology, for example design science researchers feeling that their methods are not well accepted in the IS field. This is also reflected as a barrier to journal submission in the results of this research.

"The resistance to change in the IS research field, and relevance of various methods to our context. For example, a paper on Design Science research is met with much resistance" (Respondent 3).

The above barriers could relate to international journals as much as to South African journals (and in many cases, more so). However, there is also the possibility that lack of participation in SA journals is related to either personal or institutional perceptions that it is better to publish in international journals.

"Authors may think that an International Journal looks better on their CV, and especially publishing in too many SA journals may be a negative factor" (Respondent 21).

This is particularly the case for those academics attempting to obtain NRF rating or promotion. Thus, in addition to 'making ICT research locally relevant' as is the theme of this conference, it is important to demonstrate how locally relevant research can be relevant internationally (for example in terms of reverse innovation), rather than only publishing locally relevant content in local journals. Thus responding to Walsham's (2012) call to make a better world, not just a better South Africa.

The three structural barriers will now be discussed.

Institutional Barriers. Funding is the most prevalent institutional barrier to inclusion, related mainly to conference attendance, particularly international conferences, where it is possible for a paper to be accepted but for an academic not be able to find funding to attend. This may relate to the teaching vs research focus of the university, but not necessarily. There is often lots of internal competition for limited funding and the expectation that conference presentations lead to journal publications in order bring in money for future conference attendance. More junior academics may have to rely on this limited funding, whereas more senior academics are more likely to have funds available in their own research accounts.

The lack of communication theme can be perceived as attributed to institutional factors, specifically communication and support of junior academics from seniors.

"There is no communication from the seniors about these developments and no mentorship provided by the seniors" (Respondent 32).

Of course, many senior academics are very supportive, but there is certainly a prevalent perception of the need for more support by some junior academics.

As mentioned, academic red tape is attributed to institutional factors.

"It is becoming more difficult to go through the administrative hoops required to get approval/funding to attend events/conferences" (Respondent 11).

Some academics may be discouraged from applying for funding or submitting to conferences due to the associated difficulties regarding institutional bureaucracy and funding, or repeated funding rejections, given other time pressures and the time required to complete applications. This may further exclusion in the field, reduce opportunities for dissemination of locally relevant research, and prevent further collaboration.

Exclusion based on race also emerged as related to institutional issues.

"I am co-director to a project with a colleague of mine who is white, but I do not get recognition for the work I do, yet she does and is given high priority; because she is white -yet I do all the management and coordination of the project" (Respondent 3).

This respondent is a Black African woman who feels even though her colleague and she are both co-directors on a project, the colleague gets more recognition due to her race. Other, non-specific discrimination is brought up by another respondent in terms of funding applications.

"Apparently discriminatory assessment of applications for needs and merit based funding" (Respondent 26)

Economic Barriers. Funding is also considered a barrier in terms of economic factors. This relates specifically to conference registration and conference travel.
"Conference registration fees are high and early on in one's career support for attendance may not exist. Later, when one has their own funds it becomes easier" (Respondent 23).

Conference registration fees are high and this may exclude people who cannot afford or cannot get funding.

The travel expenses involved in getting to the location of the conference or event can be high, this may a determining factor in whether or not a person is able to participate.

"Ma[n]y of the opportunities (workshops, seminars, presentations) are in Jhb. I do not have the funds to travel to these" (Respondent 20).

Whilst the attainment of funding is often an institutional barrier, the high price of registration, travel and accommodation is related to economic factors, both locally and internationally, and thus these are included as economic barriers.

Cultural Barriers. Findings regarding cultural barriers related to two sub-themes; language and clique. With South Africa having eleven official languages, it is no surprise that language is an issue.
"My own inability to speak black African language obviously limits my access/network to a black researchers and communities. This is an issue which I should address myself" (Respondent 24).

This language issue is two-directional. Language barriers prevent inclusion in the academic community for those who cannot speak or write English well, and prevent English speakers from benefitting from the research and insights of non-English speakers if we are not able to communicate well with each other.

This relates to Sen's Capability Approach where an individual is deprived of their capabilities. The white academic who does not speak an African language wants to contribute more to the community but is unable to. The language barrier is a factor that limits their contribution to the community and deprives them access to that community. Similarly, a black academic who speaks an African language may not be able to fully participate in the English-speaking community in the way they want to if there is a language barrier. The AIS SIG Social Inclusion Task Force (2017) also found that language barriers contribute to feelings of exclusion, particularly in Region 3 (Asia and the Pacific).

The second cultural issue relates to a perceived clique in the SA IS academic community. This is strongly reflected in the AIS SIG Social Inclusion Task Force (2017) survey of AIS members, who expressed similar feelings of exclusion due to this in the AIS community.
"There is a 'click' in the IS community. This click is difficult to collaborate with or network with at conferences" (Respondent 3).

There is a perception that there is a clique which seems to not want to collaborate and network with outsiders. This perception fosters feelings of exclusion amongst those who do not feel that they are part of the clique.

6.4   Suggestions for Increasing Social Inclusion

Respondents were asked how barriers could be reduced and how social inclusion could be increased in the SA IS academic community. There are eight suggestions as follows. 1) Master's and doctoral students' participation - *"Focus on M&D student inclusion"* (Respondent 35), this may help with the exclusion issues felt by junior academics. 2) Communication - *"There should be communication at all levels"* (Respondent 33). This speaks to the perception that junior academics may not be as well informed as senior academics. 3) Mentorship, this would help with awareness of conferences and journals, plus help with building networks of academics for collaboration, there is also potential for mentors to show junior academics the 'invisible rules' and norms associated with academia This would increase inclusion within the community - *"mentorship from the supervisors who are members of these IS communities. The IS community needs to be marketed widely"* (Respondent 33). Mentorship may allow access to parts of the IS community that the mentee did not have before. 4) Reduction of biases - *"The removal of gender, race and cultural details from all records pertaining to students and replacing names with student numbers in all applications for resources and participation"* (Respondent 26). This participant's suggestion may help, but will not deal with the root of these biases. Supporting Diversity and Inclusion initiatives, and adopting a Diversity and Inclusion statement may help any social biases that may exist in the community, as

recently done by the AIS. 5) Funding, a suggestion for mitigating the funding issue was to have *"Funding for younger academics"* (Respondent 12). Junior academics may struggle to get funding which leads to them being excluded early in their career. However, funding issues do not always relate only to experience and level of seniority. 6) Having a greater range of conference locations - *"Perhaps if more universities could be involved to host conferences/workshops instead of the top varsities"* (Respondent 13). 7) Creating community platforms - *"The SA IS academic community for me does not really exist. What exists is my immediate university IS community. My local community mostly interacts with the international IS community. Suggestions: - Create an IS Community platform, possibly online, to share views (papers, ideas)"* (Respondent 4). Levitas *et al.* suggest that social exclusion affects the "cohesion of society as a whole" (2007:9). Perhaps a shared online space for SA IS academics could lead to greater inclusion and a more cohesive local community for those who are not as able to participate as they would like to be due to the barriers outlined above. Online collaboration may help to address some of the barriers outlined above, and greater cohesion may lead to greater sustainability for the community, as mentioned above. 8) Advanced communications - *"Marketing of conferences long before the time as well as notifications of special calls for papers in journals"* (Respondent 1). This would enable more time for preparing papers and obtaining funding.

Many of the suggestions relate to support for more junior academics to become active members of the community, and thus is may be these academics who have a greater perception of deprived capabilities.

7   Conclusion

Receiving communications about events, conferences and journals promoted feelings of inclusion in the academic community. However, without the ability to participate in these events due to structural barriers, academics are not able to reap the benefits of inclusion such as building networks, obtaining feedback on research, and developing collaborative work. Thus, the structural barriers to participation prevent full social inclusion in terms of full participation in the activities of the community.

Whilst some exclusion is related to demographics (social biases, particularly in relation to academic rank and race in this context) the majority of barriers to inclusion relate to structural barriers, specifically institutional and economic barriers in terms of conference costs and location, and language and 'clique' reasons when attending conferences.

This paper contributes to the IS literature by suggesting four structural barriers to consider when researching inclusion and exclusion, and demonstrating the importance of looking beyond behaviours based on social biases to core elements of the social structure that may prevent full participation for those who wish to participate. Whilst the findings largely reflect those of the AIS SIG Social Inclusion Task Force. The country's history of inequality suggests that social biases may be a greater issue in SA than elsewhere. Race did emerge as one of the major reasons for exclusion in this study, and was not as prevalent an issue in the wider AIS survey. The economic barriers may also be greater in developing countries such as SA, given exchange rates for international travel.

8   Limitations and Future Research

The low response rate is a concerning factor, and further research is required to determine if there is in fact an inclusion issue in the SA IS academic community or not. The use of an online survey in this research allowed a large sample, but the inclusivity of the sample may be reflected in the fact that they are known to the mailing lists used to reach them. A truly representative study would need to approach IS academics in all SA universities, perhaps through a paper-based survey delivered to each IS or IS related department with supplementary interviews for added richness. However, the numerous similarities to the results of the AIS Task Force survey demonstrate that these results do represent the barriers to inclusion faced by IS academics both locally and internationally.

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Sustainability & Resilience

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Revisiting Sustainability: Digital Libraries in Malawian Schools

Frederik Bachmann [1[0000-0002-8950-6301]], Niels Kunz [1[0000-0001-8665-0976]], and

✉ Melih Kırlıdoğ [2[0000-0001-6043-0158]]

[1] Center for Advanced Internet Studies, Bochum, Germany
frederik.bachmann@cais.nrw, niels.kunz@cais.nrw
[2] Center for Advanced Internet Studies, Bochum, Germany & North-West University,
Vanderbijlpark, South Africa
melihk76@gmail.com

Abstract. Malawi's education system is performing poorly. A chief reason for it is the lack of education materials. The digital age provides means that can be used to counteract this shortage and enhance education. This is the aim of the "Digital Libraries in Malawi Project" (DLMP). However, like all other ICT for education (ICT4E) or ICT for development (ICT4D) projects, it is subject to the challenge of sustainability. This paper investigates the factors of sustainability component within the DLMP. The paper begins with an overview of current literature in the ICT4D area and sustainability. Thereafter the genesis of the DLMP is presented, followed by a description of the deployment of the digital resources (i.e. LibraryBoxes) at three schools participating in this project. The paper evaluates this initiative based upon five parameters for successful sustainability. The paper concludes by presenting the current sustainability prospect, proposing to the DLMP further steps and recommendations for existing and future projects.

Keywords: Malawi, Digital library, ICT4D, ICT4E, Participatory Action Research, Sustainability, Open Educational Resources.

1   Introduction

Malawi is a landlocked country located in Eastern Africa, which shares borders with Zambia, Tanzania and Mozambique. It is one of the world's poorest countries with a GDP of 6,420 Million US-Dollars (World Statistics Pocketbook, 2017 edition, United Nations). According to the UN Human Development Report of 2016, Malawi is ranked the 170th country (out of 188) with a HDI (Human Development Index) of 0.476. Indicators for Information and Communications Technology (ICT) in Malawi are well below the average of Sub-Saharan Africa, which is the least developed region in the world (see data.worldbank.org). In 2016, fixed telephone subscriptions per 100 people in Malawi was 0.1 whereas this figure was 1.1 as sub-Saharan Africa average and 13.5 as the World average. Mobile cellular subscriptions per 100 people were 40.0, 73.0 and 100.6 respectively in the same year. In urban areas, only 29% of the population has Internet access, with rural areas calculated at 7% [10]. In comparison to other African countries, the cost for internet usage is extremely high [4]. According to statistics collated by the International Telecommunications Union (ITU), the average Malawian spends more than USD 12 a month for cell phone usage. This equals more than half (56.29%) of the average income [3]. The country also suffers from frequent and long power outages [11]. It is not unusual to experience 4 to 12 hours of blackouts per day.

By educational standards in comparison to other African countries, Malawi also performs poorly [23]. Overcrowded schools have to deal with a new curriculum that is difficult to fulfill, as stated by teachers who participated in this project. The curriculum features new topics and requires new books, despite the fact that most of these books are not available in Malawi. According to a report by the Malawian Ministry of Education, Science and Technology "it is evident that there is an acute shortage of books in all the subjects" ([14], p.69). Moreover, purchasing a new set of books implies immense costs for most schools. For example, one new textbook costs between 3,500 and 5,500 Malawian Kwatcha (USD 1 = MKW 711 on 7th July 2018), as shared by a project school's headteacher. In comparison, the school fee per student per trimester in the project school Eswazini Community Day Secondary School is currently 8,500 MWK. In addition to the shortage of books, the limitation also involves other educational material such as maps, chemical substances and equipment for experiments among others. Teachers who participated in this project e.g. explained that the new curriculum also focuses on the use of digital materials and various experiments. This underlines that particularly the severe lack of educational materials keeps the schools from reaching the learning goals [22].

In a situation where books and materials are lacking, especially due to the fact that physical material is too expensive to regularly afford, digital means are a solution, if they are adapted to the local conditions and

problems (e.g. power supply, internet). Indeed, a wide range of Open Educational Resources (OER) are offered on the internet. Digital means also allow the use of visual material such as videos, and even interactive material.

In the context of ICT4E, digital literacy is an important issue in Malawi. There is a wide body of ICT4D literature about digital literacy in ICT-deprived parts of the world [1, 13, 17]. Tonero (cited in[19]) defines digital literacy as "the ability to use the internet and new media in order to access and critically evaluate different formats and types of digital information so as to participate in the socio-economic activities of a community through digital content creation, communication and exchange" (p.629). This definition actually represents an ideal and advanced form of digital literacy where individuals have sufficient resources and facilities to integrate the ICT into their daily lives. In ICT-deprived areas, digital literacy equates to a much more modest form of learning: people who have never used ICT before are acquainted with its basic functions.

The Digital Libraries in Malawi Project (DLMP) is a digital education and development project that establishes digital libraries in three Malawian secondary schools so as to counteract the shortage of books and other materials and thereby support teaching and learning. The project also seeks to enhance the digital literacy at the schools. The DLMP is supported by the charity organization Next Generation Africa e.V. (NGA) (nextgenerationafrica.org). Two of the authors (Bachmann and Kunz) of this paper are also part of the project team and they will be referred in this paper as the NGA team.

Concerning finances, the project is currently funded by private donations and a (partial) funding from the Ministry of Economics from the Federal State of Hessen in Germany. The NGA team also contributed to the project with their personal finances. Although volunteer labor and personal as well as institutional donations are quite common in ICT4D projects, it is difficult to find one where these two factors are combined. The DLMP appears to be the only case where part of the project team contributes to the project financially as well as with their efforts in the field.

In general, one of the greatest adversaries to any ICT4D project is certainly sustainability, which is the core investigative and analytical focus of this paper. As DLMP is a pilot project in its end phase, we aim to illustrate – at the present point in time – the factors which support and hinder the sustainability of the project. Accordingly, the paper also identifies possible avenues for solving the problems.

There are several important parameters of ICT4D sustainability which have been widely discussed in the literature. For example, Kumar and Best [9] identified five problem areas of sustainability, namely financial/economic, technological, cultural/social, political/institutional and environmental. Although all of these are important for the sustainability of the projects, this paper mainly concentrates on the financial/economic, technological and cultural/social aspects of sustainability.

The next section of this paper identifies critical success factors for sustainability. Thereafter, we describe the DLMP in detail and discuss it according to the aforementioned factors. In the conclusion, we summarize chances and risks for the project's sustainability, propose further steps and offer recommendations for other projects.

2   DLMP and Sustainability

It is comparatively easy to develop community ICT projects in resource-rich environments because, by definition, there are usually adequate technical, financial and manpower resources available. However, impoverished communities lack financial and educational resources required for a "natural" digitalization process. They are usually supported by external agents such as international aid donors or local governments. Usually everything goes according to the plan during the project when there is an influx of financial and manpower resources. Troubles often emerge after the official end of the project development period. The main problem is the difficulty of securing skilled manpower and financial resources required to convert the project into a self-sustained form. This is usually an almost impossible task during the course of the development process and several projects do not even attempt to address it in their official documents. As a result, the supposed benefits disappear after the development period ends and the resources dry up. Arguably, this is the most important problem in ICT4D projects which may lead to the failure in the long term [7].

Unwin [21] argues that sustainability is one of the important success factors of ICT4D along with others such as a focus on needs, using appropriate technology, effective partnerships, and addressing issues of accessibility.

Marais and Meyer [12] ask the following question for developing a thorough definition of sustainability: "Have the fundamental characteristics of the system been modified in such a way that the system will continue to sustain the benefit that has been introduced by the intervention?" The authors argue that this question "reflects the need to modify the fundamental relationships within the beneficiary system in order to realize sustained change" (p.2).

Brunello [6] provides a definition of sustainability which is suitable for low-profile ICT4D and ICT4E (ICT for education) like the DLMP projects where the latter can be regarded as a subset of the former. According to the author, sustainability is "the permanence of a flow of benefits within the system, after the development project has ended and the external funding is extinguished" (p.235). The author emphasizes the point that the benefits should be sustainable for the target population rather than the donor or the supporting team. Although the sustainability issue is one of the chief reasons for failure, it is not the only one. Building on [7], [15] and [21], the author argues that the lack of maintenance and local ownership of technology are the important factors in the high failure rate of the ICT4D projects. He also draws attention to the structural reasons which are embedded in the foreign aid "machinery."

Avgerou [2] defines the concept of social embeddedness which is helpful in analyzing the sustainability of an ICT4D project. The concept introduces the two extremes of a project's sources: at one end stand the sources which are totally transferred from outside with no roots in the community, and at the other end stand the sources which are totally developed by the community and for the community. It can be argued that the sustainability of ICT4D projects should aim to get closer to the latter extreme of this spectrum.

Breytenbach et al. [5] argue that a high level of social embeddedness, as described by Avgerou [2], accelerates the attainment of beneficiary ownership.

Ojo [16] asserts that most of the ICT4D projects are supply-driven rather than demand-driven, which means that technology is supplied with little or no previous analysis of the demand and its potential benefits. The author regards providing access as the easier part of the problem, but this often comes at the cost of a thorough plan which is integrated into the long-term national development agenda, also emphasized by Xia [24]. This results in the scarcity of locally relevant content in the projects. According to the author, many projects also lack adequate training on the field as well as the maintenance and servicing of hardware and software.

The importance of well-intentioned and capable local leaders in sustainability has been emphasized by many authors. For example, Unwin [21] argues that such leaders or champions are vital to the success of projects. Based on this literature review we have identified five parameters that influence the sustainability of the ICT4D projects. They are listed in the discussion section.

3 The Digital Libraries in Malawi Project (DLMP)

3.1 Basic Information

From a technical point of view, the core idea of the project is that small servers called "LibraryBoxes" are installed in schools experiencing a shortage of educational material as well as problems with internet access. Diverse educational content which is appropriate for secondary schools is stored in the LibraryBox.

The first prototype was developed for a test run, which was conducted in 2016 at Chaminade Secondary School in Karonga, Malawi. Following the school's request to pilot that approach in an extensive project, the DLMP, which is the subject of this paper, was realized.

The DLMP was organized using participatory action research (PAR) as its primary research methodology. This approach mainly involves the active contribution of the researchers so as to realize the project goals. This contribution may take various forms such as administering the project and performing daily project tasks. The aim is twofold: finding answers to the research questions that are developed within the context of the research and community development for social change. Sarrica et al. [18] argue that PAR is understood as both a body of theory and practice which serves as investigating the community dynamics as well as achieving community-oriented project goals. PAR can also help in the domain of design-reality gap [7] which aims to understand the causes of success and failure of the projects by analyzing the disparity between the imagined system and the real-life conditions.

It was also aimed to involve many important local stakeholders from the very beginning. One reasoning behind this was that the participation of the local stakeholders might provide the key to the long-term sustainability of the project.

With this in mind, the DLMP has been performed in four phases:

Phase 0. Desk research, sampling of pilot schools, building local partnerships, analyzing the pilot schools' environment, testing a prototype miniserver, further elaborating the concept with teachers, students and the Diocesan Education Secretary. Talks to all involved (students, teachers, heads, traditional leaders, school authorities, Ministry of Education etc.), preparation of the technology (2016/2017).
Phase 1. Installation of the technology (by NGA team, each school's digital library champion (term explained in section 3.6) and a local technician), digital literacy workshops, NGA team accompanied and supported the schools for a few weeks, ongoing scientific analysis (January/February 2018).

Phase 2. Frequent training sessions, technical support by the local technician (March – May 2018).
Phase 3. Final evaluaion of the pilot project (June – July 2018).

3.2   Project Schools

The main characteristics of the three project schools — Chaminade Secondary School (Chaminade), Eswazini Community Day School (Eswazini CDSS) and St. Mary's Girls' Karonga Secondary School (St. Mary's) — are summarized in Table 1. Chaminade and St. Mary's are rather close to the town of Karonga, while Eswazini is in a very remote rural area. Chaminade and St. Mary are boarding schools which are administered by the Roman-Catholic Diocese of Karonga. They have more resources than Eswazini. However, the lack of educational material as described above is a problem at all three schools, likewise the challenge concerning frequent power outages and the unreliable (and expensive) internet connection.

Table 13. Information about the three project schools.

	Chaminade	Eswazini CDSS	St. Mary's
Location	Karonga	Eswazini	Karonga
Urban / rural	Rural	Rural	Rural
Propietor	Mission (Catholic)	Public	Mission (Catholic)
Type of School	Grant aided boarding	CDSS	Grant aided boarding
Type of Institution	Boys only	Co-educational	Girls only
Number of Students	480	91 (48m, 43f)	286 (half capacity)
Number of Teachers	20	9	10
Forms	4 (3 classes each)	4 (1 class each)	2 enrolled (3 classes each)
Main Power Source	ESCOM (main grid)	ESCOM	ESCOM
Generator	Yes	No	Yes
Classrooms	12	4	12
Computer Lab	1	0	1

3.3   Technology

The LibraryBox is a special low-cost server developed by the NGA team for this project. Installing a high-tech solution in Malawi would not be appropriate given Malawi's ICT environment, as outlined in the introduction. The technology should be simple and cost efficient, while also adequately powerful for the purpose. The LibraryBox was especially designed for these local circumstances. There are currently two prototypes. The first one contains 1TB hard drive (500 GB for content, 500 GB for backups) and 16 GB RAM. It also has an uninterruptible power supply (UPS) which is essential given the electricity problem in Malawi. All web-enabled devices (WiFi or LAN) such as desktop PCs, laptops, tablets and smartphones can access the content via LAN or WiFi directly from these servers. It is possible to stream videos on more than 30 clients at a time.

The second prototype, the LibraryBox Lite, is a smaller and less costly version where the server and the client are in the same hardware. It is a laptop-server and therefore has a battery to secure access to its contents during power outages. This version has a 500GB hard drive and 4 GB RAM. It can be used to access the content itself as well as providing content to other devices. Fewer clients can be connected to the LibraryBox Lite than on the LibraryBox. This solution was chosen for Eswazini CDSS which has a weaker infrastructure than the other schools.

Viruses are a very pervasive problem in Malawi, since licensed IT-security software is quite expensive and updates (for the operating system as well as for the IT-security software itself) require internet access. The LibraryBox alleviates this problem by running a server solution anti-virus programme, which means any updates to the contents need to be done in the LibraryBox and will then be distributed to clients.

3.4 Content

To address the schools' limited educational material (books, maps, etc.), the content provided on the digital library has to be adapted to the needs of the beneficiaries. It must also meet the guidelines of the government. The content was curated following the suggestions from teachers and students, and according to the Malawian curriculum. It was mostly sourced from the internet (e.g. OER). So far, DLMP's digital library provides educational material in three major categories:

- Offline web sites
- Collection of different media types (pictures, videos, texts, simulations)
- Software applications

The offline websites currently comprise the free encyclopaedia Wikipedia, the Simple English Wikipedia, Wikibooks (e-books), Wikiversity (learning resources, learning projects, and research), Wikispecies (a catalogue of all species) as well as Wiktionary (a free dictionary).

The media files were compiled according to the Malawian curriculum and mostly from online available OER platforms. They include maps, videos of experiments, audio dictations in foreign languages, examinations from former years, pictures of historic events and more. The collection of files can be enhanced by teachers and students. The majority of teaching material on the net is in English and this is an advantage, because it is the language of instruction in Malawi. Still, due to the nature of this pilot project, there is still room for completing an ideal collection. During the pilot project teachers are encouraged to add their own ideas, e.g. by creating presentations on certain topics to be shown in the classroom. These additional materials will be exchanged amongst the project schools.

Software applications can be downloaded and installed on client devices. Besides programmes to learn coding (Scratch) and maths (KA Lite), there are anti-virus applications and other software (browser, OpenOffice, video player etc.).

All three pilot schools are given a least one dongle (and a certain data bundle per month) to download content from the internet by themselves. The project champions, i.e. the stakeholders who spend more time and effort on advancing the project, have initiated a communication channel among themselves via WhatsApp. The WhatsApp group exchanges the newly developed content among all three schools. This takes advantage of the "Social Bundles" of the internet Service Providers that allow reduced data volume prices for services like WhatsApp. To enable a frequent content exchange, an automatic synchronization of the digital libraries via the internet is planned. The updates will be done at regular intervals, e.g. once a month. For this, schools neither need large data bundles nor a constant internet connection. For project schools which might lack any internet connection, an offline content exchange can be implemented. This will be addressed in the discussion section.

3.5 Implementation of the Digital Library

The technical resources which existed at the schools before the project started, were used for the purposes of the project. For example, in the case of St. Mary's and Chaminade, the schools already had computer rooms which had been donated by a charity. Prior to the DLMP, these facilities were rarely used due to the unreliability of internet access and other problems (e.g. viruses). Currently, the computers are connected with the LibraryBox and can be used by teachers and students for offline research and other activities. Teachers also use their own laptops or their smartphones for accessing the content. This is another advantage, because smartphone usage is common among the teachers (nearly all teachers at the project schools own a smartphone). Under the auspices of the DLMP the schools were equipped with laptops, which can be borrowed by teachers for personal usage or for the lessons. To make sure that spare parts are available locally and warranty is valid in Malawi, a local technology seller was chosen for many hardware acquisitions. All schools also received projectors with which content can easily be presented to the whole class. At the two boarding schools a room with a projector and one laptop (for the teacher) was set up as a "digital library room." At Eswazini CDSS, there is a portable projector used for all four rooms. Additionally, the staff rooms at all schools have been equipped with at least one computer that can always be used by teachers. This is very helpful for teachers who do not have their own devices.

3.6 Social and Cultural Aspects, Local Embeddedness and Responsibilities

The installation of the technology was accompanied by a set of accompanying social measures along with some other measures with a pedagogical dimension. The main reason for this approach lies in the attempt to build the project using the existing social and pedagogical structures, to lead the project together with the beneficiaries, to

create skills and capacities allowing an effective and autonomous use of the technology as well as social measures embedding and promoting the project in the beneficiary system. The project's embeddedness [2] can be divided into three levels: school level, regional level and inter-regional level.

At the schools, the DLMP was conceived in cooperation with the beneficiaries in the preparatory stage (phase 0) in November 2017. In a series of meetings and interviews with the beneficiaries, the specific needs of the schools were expressed and the requirements that the project must meet were compiled. Also, the necessary content and the accompanying pedagogical measures were defined with the beneficiaries. These requirements were recorded in an implementation plan that detailed workshops, milestones, etc. Additionally, frequent meetings with everyone involved in the pilot project were scheduled to review the stages of implementation and to plan the way forward.

In the course of the DLMP, at each school, specific roles for teachers and students were defined according to the existing staff structures. There is one teacher in each school tasked with administrating the project and s/he is regarded as the digital library champion. Malawian secondary schools have a student prefect body which covers a diverse area of school life (health, sports etc.). The role of two digital library prefects has been established in each school. The prefects and the champions function as organizers, problem solvers, leaders and contact person for their colleagues and peers.

At the regional level, the community around the schools actively participated during the pilot phase. In the case of the two boarding schools i.e., St. Mary's and Chaminade, the Diocese's officers for education and development took part in the planning and organization of the project. They also assisted in conducting the workshops and report the latest developments to the Bishop who is using his network and influence for the promotion of the project. For the remotely located Eswazini CDSS, the situation is different. The important social contacts at Eswazini are the two groups: the PTA (Parents-Teachers-Association) and SMC (School Management Committee). Additionally, the region's traditional authority (the chief of tribes in the Northern area of the Mzimba district where Eswazini village is located) supports the project as an influential social figure. The chief was regularly met for discussions and project updates. He also uses his network to find partners and explore new possibilities for the project.

At the inter-regional level, the team partnered with Chancellor College, a constituent of the University of Malawi, in particular with the Department of Computer Science in the Faculty of Science. They conducted workshops for the project school teachers. After the end of the current pilot phase, the project will be jointly conducted with the Chancellor College, whereby the latter is the main agent on ground (e.g. implementation and support of the digital teaching and learning platform). With their expertise in education, they will also develop new content for the digital libraries. Additionally, the college plans to integrate the digital teaching and learning platform into its curriculum, including technologies for teaching and learning in its Bachelor of Education programme. Final talks are ongoing.

3.7   Pedagogical Accompanying Actions

At this point it is worth emphasizing that the issues of technology use within the education domain (e.g. in the context of ICT4E) is a large and rich domain of research where a lot of previous work and literature exists. One example is the technological pedagogical content knowledge (TPACK) framework of teacher knowledge [8] which builds on pedagogical content knowledge (PCK) model by Lee Shulman [20]. TPACK analyzes the three bodies of teacher knowledge, namely content, pedagogy and technology as well as the complex interaction amongst them. For the purposes of this research, digital technology is regarded to be "servicing" the main "aims" of developing and using appropriate content for effective pedagogy in the teaching process. During the DLMP, it was expected and found that the teachers already had a robust understanding of the content knowledge and pedagogic knowledge. The idea of imposing a pedagogical concept onto the schools from an external perspective would go against the very aim of the DLMP. The schools are administered by the local teachers who are knowledgeable about the conditions. They are also trained professionals. Chaminade is currently ranked as the second most successful school in Malawi. This is why the pedagogical efforts of the DLMP focused on imparting digital literacy and the interactions between content, pedagogy, and technology knowledge to enhance TPACK. In practical terms, this entails transferring knowledge and equipping teachers with skills of how to use technology as a supplement to their classroom activities. It also seeks to promote a more effective way to teach content, rather than inventing an entirely technology-centered pedagogical approach. Nevertheless, such a radical approach would be inappropriate due to several reasons including the NGA team's inexperience and limited knowledge of the local conditions as well as the unreliable technological infrastructure. The transfer of technological knowledge is aimed at building the digital literacy in the beneficiary system (schools and everyone involved) which enables certain autonomy of the beneficiaries. With this in mind, the following pedagogical measures were taken.

The implementation started with an intensive workshop for teachers, followed by workshops for students. The project champions co-conducted those workshops. The basics of using a computer, how to navigate in the operating system and how to access and use the digital library as well as how to apply technology for teaching and learning purposes were conveyed. A teaching concept of eight modules was created. Also, throughout the whole pilot project, several training sessions most of which are especially for teachers, were executed by the project champions. For further practicing outside the workshops, headmasters and champions have determined times and places for using the system. Additionally, as stated, Chancellor College organized computer literacy training for teachers at St. Mary's and Chaminade.

Schools need to be able to troubleshoot any problems quickly and efficiently. Troubleshooting mechanisms were defined with the aim of avoiding the dependency on a single person or source. This includes, for instance, a user guide (a printed manual with pictures) for self-help. It was drafted before the implementation and was further developed during the course of the project. There is also a special expert guide for the digital library champions and this guide contains advanced topics and special cases. The guides are available as hard and soft copies. If the user guide cannot help, the problem may be presented to the fellow teachers and/or students to combine forces and come up with a solution collectively. If the problem persists, then the assistance of the project prefects and the project champions may be requested. Whenever technical support and maintenance is needed, an external technician can help to solve problems. For this purpose, a technician was employed and jointly paid by the project team and the Diocese. In the long term, he will be paid by the Diocese only. In case of any persisting problems, Chancellor College (or even the NGA team) can be contacted directly for supporting the schools remotely by software like TeamViewer which allows a user to operate a computer remotely. This of course is dependent on the existence of an internet connection through data bundles. Chancellor College will also assist with on-site help.

3.8   Discussion – Risks and Chances of Sustainability

On the basis of the detailed description above, this section will examine the DLMP according to the five parameters of sustainability.

Driven by demand and national context. The DLMP was initiated at the request of the teachers and students and it was planned in collaboration with the beneficiaries. This process involved a thorough analysis of the needs and the local environment. The digital library was integrated into the existing facilities of the schools, e.g. the computer labs were used. Given existing internet deficiencies, an offline approach was developed. By adjusting the concept of the project and the content of the digital library to the schools' needs and the regulations of the government, specifically the curriculum including its topics and methods of teaching, the project is to a certain degree integrated into the long-term national development agenda as emphasized by Xia [24]. Moreover, Chancellor College will create content that is relevant and fitting to Malawi's social and national context. Many teachers and students have said that useful content is the chief criterion for using the digital library, and so it is likewise crucial for the project's success in terms of sustainability. However, the internet does not provide enough OER material relevant to countries like Malawi, fitting to its specific subjects and teaching habits. It is necessary to curate and develop nationally relevant content (e.g. by finding local content creation partnerships). We argue that this should be one of the first priorities in any ICT4E project, and particularly in those addressing material shortages. Academic institutions, familiar with local teaching methods can be useful partners in this regard. Especially so-called scripts, similar to school books, are demanded where texts, pictures, etc. are readily compiled with clear guidance for the instruction in class.

Appropriate technology. The LibraryBox system is primarily used offline because the content is stored offline. For downloading new content onto the LibraryBox, the schools need data bundles. This is also necessary for software updates or content exchange with other schools. During the pilot phase, such bundles were given to the schools. An advantage of this system is that only the server gets the update, not all devices which reduces the data traffic. Still, schools may struggle to pay for this themselves. Chaminade and St. Mary's have already bought data bundles (encouraged by the DLMP). But this may be a hindrance to Eswazini's budget. The internet use must be further reduced – by requiring fewer updates or downloading updates at one central place and then sending USB sticks through the local bus system to all schools.

Unlike laptop servers, laptop-clients and smartphones, projectors and desktop computers (e.g. in computer labs) need external UPSs which are not always available. As a result, sudden power outages can interrupt the lessons, if desktop PCs are used. This can lead to disappointment in teachers and students as well as weakening the trust in the technology and the motivation to use it. This is why the use of battery-driven technology needs to be increased. The boarding schools' generator is no solution for the long run either, due to the high costs of fuel.

A constant power supply, e.g. solar or similar solutions could help, but their initial and maintenance costs are again too high.

Overall, the technology used for the DLMP is relatively affordable. But it was donated and not paid by the schools. If hardware damages occur, replacements can be found (because the technology was bought locally), but the parts are expensive. Also, the schools cannot afford further costs such as acquiring more laptops. The possibility to connect smartphones to the LibraryBoxes may partly compensate the problem. However, smartphone interfaces are not as user-friendly as PCs. The schools may get external donations in future: There are many charities donating IT infrastructure to schools in Malawi. Furthermore, there are "lease to own" programmes by some NGOs. This means computer rooms are installed at schools for a yearly leasing cost of about MWK 160,000. The service also includes maintenance. After three years, the computers become property of the school.

As a result, although cheap technology was used, the project requires external resources in future. This may have adverse implications for sustainability. The efforts in investigating or designing affordable technology must be deepened. Ideally, the schools should acquire technology locally (e.g. through leasing programmes).

Adequate training. The training and skill building ensure that the schools do not depend on help from outside. The inclusion of such measures also allows for a quick adoption of the digital library into the daily teaching. Additionally, the user guide's tips and instructions specifically gear towards the needs of the schools. Still, if teachers are transferred, which happens quite regularly, valuable expertise is lost. New teachers must be trained in this case. The school's own champion or the champion in another school may help for this. Also, the Chancellor College will take care of continuous trainings. This ensures that the schools have the required level of skills available and new teachers are instructed properly.

Local availability of skilled manpower and financial resources. The NGA team frequently visited the project locations in Malawi. Due to their other commitments they will not continue their current level of involvement after their final visit in May - June 2018. The question arises whether the project can keep growing with only local resources and management [5]. The support and daily operations need to be transferred to the local actors. The main local actor will be the Chancellor College. They are supposed to serve as a national project management board, a role for which they have both personnel and expertise available. Given the possible project expansion in future, their support is particularly decisive for schools without connection to an external institution. For example, the Diocese will take care of the project for its own schools, but Eswazini has no such external support.

As stated, on site, the champions and student prefects are responsible for the DLMP. They also share experiences with the other schools' leaders. For instance, one school's champion can temporarily support another school.

Furthermore, local technicians are needed to support the schools. In Karonga, the local technician will further take care of the maintenance. The Diocese's technician also supports Eswazini. Chancellor College can organize other technicians for other schools.

The remaining problem are the finances: IT infrastructure and personnel costs are high, but the Chancellor College also needs funds for managing the project (transportation, accommodation etc.). The agreement between the Chancellor College and the NGA team includes that both parties should identify and apply for funding. All of this funding is currently not likely to be found locally. However, there are aspects of the project that can be performed with local resources and management only. For example, teachers can create and exchange new content. Mechanisms for local financing have to be investigated. For example, the schools could open the digital library to the community for a library membership fee.

Social embeddedness and beneficiary ownership. We have already mentioned the demand-driven approach in ICT4D projects. The project has been planned and facilitated by the NGA team together with students, teachers, technicians and Diocese officials. The beneficiaries have a high level of control in this process and their input leads the NGA team's efforts. Therefore, the project can currently be described as "with the community." Continuously, the NGA team strives to transfer all management and control to the locals. Skill building measures aim at an independent use of the technology. Additionally, the local community and the relevant social actors are involved: at the boarding schools, the Diocese and at Eswazini the PTA and the SMC as well as the traditional authority. Perhaps most importantly, the project has now the support of the Chancellor College.

4 Conclusion

We now conclude by summarizing in how far the sustainability parameters are fulfilled. After that, we will outline the next steps for the DLMP as well as give recommendations for other projects.

- In contrast to most ICT4D projects which are supply driven [16], the DLMP can be regarded as demand-driven and to a certain degree it is integrated into the long-term national development agenda [24].
- The technology works primarily offline, but some tasks need internet connection. Schools with small budgets may not be able to afford this. Further, not all devices have a UPS and solar energy solutions are expensive. Electricity outages limit the system's functionality. This is demotivating to the beneficiaries.
- The skill building in DLMP fulfills the condition of adequate training stated by Xia [24]. The trainings are meaningful for the sustainability and the project success.
- The champions and prefects function as local leaders and are vital factors for sustainability, as argued by Unwin [21] and others. The Chancellor College will be able to lead the entire project in future. They can also employ local IT personnel to ensure proper maintenance.
- Finances are still a problem with regard to personnel and also e.g. IT infrastructure (which, relatively to local conditions, is still expensive).
- The project already shows a high level of social embeddedness, as described by Avgerou [2], and the control of the beneficiaries is also increasingly achieved: The Chancellor College will manage the project nationally.

These are some of the steps DLMP should take in future:

- More battery-powered devices need to be used and affordable solutions for a constant power supply need to be investigated.
- The internet requirement must be further decreased, e.g. fewer updates or centralised updates, and distributing memory sticks by busses.
- Further investigations into affordable technology needed. Use of leasing programmes can be solution.
- Investigation of sufficient financing mechanisms may be required, e.g. through local business models.

These are recommendations for other projects:

- A digital, offline approach for providing educational material locally, in areas where the internet access is somewhat limited, by applying technology such as cost-efficient mini servers adapted to local circumstances, like the LibraryBox.
- The curation and creation of locally relevant content should be a key priority in ICT4E projects like the DLMP. Content curation from OER alone, in the majority of cases, does not suffice for the local needs.
- Trainings are meaningful for the sustainability and the project success; however, they must be conducted with or by local experts (e.g. computer teachers/champions), and they have to be continued after the outsiders leave.
- It makes sense to have higher academic institutions as local partners: They usually have the expertise and resources available and can facilitate many of the crucial aspects: content, centralised updates, trainings, support and maintenance.

Finally, we can summarize that the decisive challenges to the sustainability of the DLMP are electricity and finances. Provided that financing mechanisms that can also solve the electricity problem can be found, the analysis suggests a rather positive sustainability prospect.

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Scoping community resilience concepts relevant to a South African definition for resource constrained environments

Sifiso Dlamini[1][0000-0002-3756-4980], Marlien Herselman[2][0000-0003-1089-3925], Mario Marais[3][0000-0002-3756-4980]

[1]CSIR Meraka Institute, Meiring Naude Rd Pretoria, South Africa
✉:sdlamini@csir.co.za

[2]CSIR Meraka Institute, Meiring Naude Rd Pretoria, South Africa
Mherselman@csir.co.za

[3]CSIR Meraka Institute, Meiring Naude Rd Pretoria, South Africa
Mmarais@csir.co.za

Abstract. The purpose of this paper is to indicate what aspects should be considered when developing a definition of community resilience for the South African context, with a special focus on using ICT in rural educational contexts. The aspects will be constituted by applying a scoping literature review ranging from 2014-2018 and examine the extent, range and nature of research activities on the following concepts/search terms: *resilience, social resilience, community resilience, community focused resilience, adaptive capacity and social capital*. We investigated international electronic databases including ACM digital library, IEEE Xplore, Scopus, ScienceDirect, Harzing's Publish software Scopus, ISI Web of Science and Google Scholar. The search terms were applied for titles, abstracts and keywords. Extracted data were analyzed in terms of resilience definitions, types of resilience, domains, and community resilience assessment. Results: A table with the most important concepts to consider were developed based on the scoping review where only 17 papers were found to be best suited to the purpose of the paper out of 675 publications initially identified. These produced a diverse set of aspects to consider with regard to the definition of community resilience which can be applied when developing this definition specifically for a South African context where ICT is applied in rural education. Considerable inter dependency between and among aspects of the concept community resilience also emerged from this analysis and a Wordle is provided to summarize the most essential aspects to consider at the end of the paper.

Keywords: community resilience, ecosystems, scoping review, adaptive capacity, social capital.

1 Introduction

Internationally community resilience has become a dominant theme especially in the development research area [1]. The word resilience according to [2:p.49] originated from the Latin word "resiliere," which means to "bounce back." The common use of resilience as a word implies the ability of an entity or system to return to normal condition after the occurrence of an event that disrupts its natural state. Such a broad definition applies to such diverse fields as ecology, materials science, psychology, economics, and engineering [1].

Within a community perspective, resilience is generally understood as a community's ability to withstand, mitigate, or adapt to outside pressures and shocks, and it encompasses the geospatial qualities of community, important to programming and intervention implementation and the capacity building component critical to sustainable development [1,3-9].

Community resilience is also important in sociological investigations of community responses to change, states [1]. Within the community resilience perspective or in ecological resilience it seems impossible to talk about resilience without mentioning adaptive capacity. Adaptive capacity is understood in the community resilience literature, to the capacity of communities to cope with, adapt to, and shape the nature of environmental, economic, and social change [10,11 & 12]. Apart from this adaptive capacity, resilience and sustainability is also recently regarded as one and the same thing or concept, by one group of researchers whilst the others claim that these two are completely different and unrelated [13]. The adaptive resilience according to Cutter [14] is the ability of individuals, stakeholders, or communities to learn from and respond to changes precipitated by some hazard event. It normally is a process involving social learning, but it also can have a measureable outcome.

Community resilience has become a dominant theme in the international development and particularly being able to return to the pre-disaster state [2, 27&28]. It is important to note that there are conceptions of resilience that not only look at a community in its proneness to disaster, its ability to absorb and reorganize itself

post disaster. There are multiple views of community resilience that go beyond disaster and being able to cope or survive it. The challenge posed by these views however is that resilience is always understood in the context of surviving disaster or a shock and little to do with preventing it. Cafer [1] takes a geospatial perspective where community resilience is seen as encompassing the geographical and spacial elements of community which are essential for programming and intervention implementation and the capacity building component critical to sustainable development. Roberts [2] introduces a different dimension to community resilience by looking at the existence, development and engagement of community resources by community members who intentionally develop personal and collective capacity to respond to and influence change, to sustain and renew the community and to develop new trajectories for the communities' future. This perspective of community resilience brings to the dialogue a notion of social cohesion or social capital where various elements of the system work together for the benefit of the system. ODI [27] refers to this form of community resilience as "resilience at a local level". The local level of resilience takes into cognizance the importance of the individual, household and the community. This view is essential to the dialogue in anticipating the development of a South African definition of community resilience for Information Communication Technology in rural education, particularly since the focus is not only on education as a system but the whole ecosystem that includes individuals, households, communities, institutions of government and the private sector.

Despite the growing importance and interdisciplinary adoption of the resilience construct, no clear definition for this term has emerged and many authors refer to its indicators as a tapestry of possibilities and operationalizing the definition presents its own set of challenges [15-19].

This means that not only is it important to operationalize resilience, how it is operationalized must be able to encompass, for example, the hazard, cultural and national diversity that prevails in an international context. In addition to developing a robust operational definition, it is important to identify why there are differences between communities with regard to levels of resilience. That is, it is also pertinent to identify the variables and processes that influence or predict resilience.

Therefore the purpose of this paper is to identify elements/aspects which are essential to the development of a South African definition of community resilience in education, particularly for communities with resource constraints. This will be done by looking at the wider understanding of resilience and drilling down to the elements which are essential for community resilience and then link it to rural education where mobile technology is used or introduced. Once these elements were identified these can assist in conceptualizing a framework of community resilience for SA as a future goal.

2   Research question

The research questions for this paper are: what aspects should be considered from the latest literature, by applying a scoping review, when developing a definition for community resilience for South Africa?

The focus is specifically on rural schools in resource constrained environments as these are influenced by other dimensions than urban schools do and these also face more challenges when implementing mobile technologies, like the lack of internet access and electricity. These schools are also sometimes referred to as resource constrained as access to basic resources are now and then a challenge. According to Botha & Herselman [26,31] a resource constrained context where rural schools are found is an environment where there is low income communities and low bandwidth. These environments provide unique constraints (e.g. cultures) where people are unfamiliar with, or afraid of, technology and/or environments where power and network connectivity are scarce and expensive. In these rural spaces not only is accessibility or usability of technologies a challenge, in some instances geographical configuration of the area poses a challenge of accessibility to the sites or network configurations due to poor line of sight. Often, urban frameworks focus primarily on systems, institutions and policies that deliver resilience, rather than on the agency of people and the resources available to them [27]. These environments according to Pangrazio [27] may also lack the competency and skills necessary to take advantage of the digital age and knowledge society due to challenges with the digital inequality and the digital divide.

3   Methodology

For the purpose of this paper a scoping literature review was applied. There is no universally accepted definition or purpose for a scoping, however, the main characteristic of this method is that it provides an overview of a broad topic [33; 21] Colquhoun et al. [21: p.1292] define a scoping review as "a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge". This definition is similar to descriptions of scoping reviews from other studies which state that scoping reviews aim to establish the current state of research in a particular subject area [22; 23,24]. Arksey & O'Malley [25] point to the following reasons for conducting a scoping literature review:

- examine the extent, range and nature of the research activity;
- determine the value of undertaking a systematic review;
- summarise and disseminate research findings; and
- identify research gaps in the existing literature.

Peterson et. al. [33] argues that there are major differences between a scoping review and a traditional systematic review with a meta-analysis. Both start with a primary question on which inquiry is focused, however, a scoping review allows for a more general question and exploration of the related literature, rather than focusing on providing answers to a more limited question [34]. Dijkers [32] provides a good distinction between a systematic literature review and scoping literature review. The table below provides a simplified distinction of the two.

Table 1: Difference between systematic and scoping reviews

Systematic Literature Review	Scoping literature review
Typically focus on a well-defined question where appropriate study designs can be identified in advance,	Tends to address broader topics where many different study designs might be applicable
Aims to provide answers to questions from a relatively narrow range of quality assessed studies	Scoping study is less likely to seek to address very specific research questions nor, consequently, to assess the quality of included studies

A scoping review was applied to examine the extent, range and nature of research activities on the following concepts/search terms: resilience, social resilience, community resilience, community focused resilience, adaptive capacity and social capital.

These concepts were scoped in both developed and developing countries to contextualize knowledge by identifying what we know and do not know. The process of synthesizing publications, retrieved from the search, was qualitative in nature. The focus is on (rapidly) making sense of a broad body of knowledge.

Arskey & O'Malley [25] provide a framework for performing scoping review which was adopted in this paper. This framework guides the researcher to identify the research question to examine and summarize breadth and to identify studies relevant to the search terms. This is followed by the study selection stage to determine the inclusion and exclusion criteria. Data is then charted and used to extract facts from each study to get to the thematic construction, which covers an overview of the breadth of the literature. A numerical analysis of the nature and extent of studies using tables and charts is presented. A thematic analysis is then presented. This can be followed by consulting stakeholders to suggest additional references but this last stage was omitted in this paper.

To find relevant papers and documents on the key phrases, the following databases were used: ACM digital library, IEEE Xplore, Scopus, ScienceDirect, Harzing's Publish or Perish software was also used to identify highly cited studies which were not indexed in the databases. To access other relevant publications, a manual search was conducted using the Google search engine. The search period was from 2014 to 2018. The search was conducted in March 2018. From the 675 article which we initially found only 17 were found to be most suitable to address the purpose of the paper.

4 Scoping the concepts

This section of the paper will indicate what results the scoping review revealed on the search items to determine the most relevant aspects when conceptualising resilience within a SA context. The approach will be to first get a broad understanding of resilience and also identify essential elements to be considered when developing the South African definition of resilience. Following this, a brief overview will be provided on the use of mobile technology in resource constrained schools as this also will play a role in developing this specific definition for South Africa.

4.1 Understanding resilience

The definitions of resilience across the frameworks are not uniform, and it seems practically impossible to get to a universal definition as its relevance and applicability depends on the context and perspectives of what resilience are for whom. There are however elements of resilience which are found in most definitions. While definitions of resilience vary, in general, they state that resilience should enable systems to function and flourish in the face of shocks and stresses [27]. The term resilience entered the English language in the early 19th century referring to "the ability to recover from adversity" and over the last 40 years this concept has continued to evolve into a number of types of resilience applied to different scopes and contexts [28]. Hoffman [34] defines resilience as the systemic capacity to change as a result of circumstances that push the system beyond the boundaries. Marchese [13] viewed resilience as the ability of a system to prepare for threats, absorb impacts, recover and adapt following persistent stress or a disruptive event. Resilience is understood as the capacity of individuals and communities to proactively adapt to constant change through processes of building capacity and resources [2].

Heeks and Ospina [35] look at the foundational attributes of resilience in their attempt to position resilience in the Information Systems domain. They see resilience as containing three foundational attributes namely: robustness, self-organisation and learning. These three then provides three working definitions of resilience which are: the ability of the system to maintain its characteristics and performance in the face of contextual shocks and fluctuations, ability of the system to independently rearrange its functions and processes in the face of an external disturbance, without being forced by the influence of other external drivers, and capacity of the system to generate feedback with which to gain or create knowledge, and strengthen skills and capacities necessary to experiment and innovate [35]. All the above mentioned definitions and conceptions have one unique problem, they view disaster as something that is bound to happen and make no mention to preventing shock. Most of the definitions contain the word withstand, and the word in its definition does not mean to prevent but to serve. Nevertheless, central to the definitions of community resilience are the following elements: resilience in a system/ecosystem, the role of community in building resilience and the ability to adapt/adaptability.

4.1.1 System/Ecosystem perspective. All the definitions of resilience mentioned in this paper position a state of resilience within a system or ecosystem perspective. Whether from an ecological, sociological, economical or information system, resilience is always seen in a context of a system. Positioning resilience in a system or ecosystem perspective provides a good reference point in terms of what state of resilience is desired for what purpose and resilience for whom. In the case of the South Africa, and in particular the use of ICT in rural education; an ecosystem perspective is relevant as the focus is not only on the education (system) but a bigger ecosystem which looks beyond just the school [24,34], but also take into consideration the context of the school in relation to the community, households and individuals. It is also worth noting that most definitions of resilience look at resilience as the system's ability to withstand shock [2,24,35]. This view of resilience positions a system in a preparedness state, that is, when the shock comes/hit, the system will be able to survive it. This definition is mainly used in the ecological perspective of resilience which mainly thinks of shocks as externally imposed attributes. This perspective of preparedness for external shock is not relevant to the rural education space as the problem may not be an external attribute that come at the certain point in time. The challenge may be a slowly decaying of an education system, resource constrains, lack of technical skill to use technology, inability to afford technologies and connectivity [26,27,31].

It is for these reasons that Sanchez's [29] definition of resilience becomes meaningful to this South African context (ICT/mobile ICT use in rural schools). Sanchez [29] highlights the notion of a socio-ecological systems approach which is based mainly on three aspects: (i) being able to absorb disturbances while remaining within a "normal" or acceptable state; (ii) capacity to self-organise; and (iii) being able to build capacity for learning and adaptation. The concept of socio-ecological resilience focuses on disturbances which can be chronic slow stresses or acute rapid shocks this concept is overlooked by handful of authors who only see resilience in "shock which may come" instead of existing problems in the ecosystem which requires the community to self-organise to combat the problem, which particularly builds community resilience.

4.1.2 The role of community in building resilience. Generally, urban frameworks focus primarily on systems, institutions, and policies that deliver resilience, rather than on the agency of people and the resources available to them [27]. The notion of community resilience is essential when working in a resource constrained environment. Community resilience as referred to by [1,2,4,28] or resilient at a local level as termed by ODI [27] encompasses the role of the community, the household and the individual. Community resilience provides a systematic approach to measuring resilience at the community level and it takes the view that community level resilience involves improving the knowledge and health of communities; strengthening the social cohesion of communities; developing well-maintained and accessible infrastructure and services in communities; providing economic opportunities; managing natural assets and strengthening the connectedness of communities [27]. This form of resilience refers to the resilience of the inhabitants of a human settlement and their social constructs whether as a group or as individuals [1]. Hosseini et. al. [2] defines community resilience as the ability of community members to take meaningful, deliberate, collective action to remedy the effect of a problem, including the ability to interpret the environment, intervene, and move on. Central to community resilience is the notion of social capital and social contract. It is social contract that instills the view in the community that the success of every individual is dependent on the success of the community, thus highlighting a need for collective effort.

The community resilience element is relevant for building the South African theory of resilience particularly for the resource constrained environments as it positions a person and a household into a broader social structure of society. It is for these reasons that Roberts et al [30] refer to community resilience as the existence, development and engagement of community resources by community members who intentionally develop personal and collective capacity to respond to and influence change, to sustain and renew the community, and to develop new trajectories for the communities 'future. In the South African rural context trajectories may mean anything between accepting the use of technologies for teaching to using collective action to safeguard technologies at schools and mobilizing resources to ensure sustainability of ICT interventions at schools.

It has been realized through various ICT in rural education initiatives implemented by the CSIR in resource constrained environments in South Africa, that the role of the community is crucial to the sustainability of the implementations at schools. What often make these initiatives work in the rural context is the involvement of the community in supporting, promoting and encouraging the use of technologies at the school. Roberts et al. [2] is of the idea that ICTs and Internet access are increasingly considered vital to the resilience of rural communities, especially if the focus is on in rural areas in academic literature in terms of rural/urban digital divides (those who have and those wo don't). Geographically, rural populations are more difficult and costly to service with deployment of fibre optic cables for broadband Internet, which provides faster speeds than existing copper networks, and lack a commercial incentive, and therefore many rural inhabitants still receive a much slower and poorer service [2]. The challenge of connecting such communities on not only the cost of putting up the infrastructure, in some areas, as was the case with the ICT4RED project in the rural Eastern Cape [26], some schools did not have electricity and the geographical positioning of the schools made it difficult to connect them to the internet. As a result VSAT connection was the only option available. The concept of community resilience is essential to the dialogue on building resilience framework and for defining it for South Africa as it provides the broader perspective on what is needed to make ICTs work and add value to rural contexts. There is also a notion of adaptive or adaptability which is essential to the notion of resilience.

4.1.3 Adaptive and or adaptability. A number of authors touched on the notion of adaptive and adaptability as an essential element of resilience, and the definitions of these depend on the context to which resilience is positioned. Although there is no universal definition of adaptability, various attempts to explain adaptive or adaptability included: creative problem solving, coping with uncertainty, learning new tasks and skills, adapting to teamwork and collaboration, changing procedures and developing new procedures, and adapting across cultures [11-13]. According to Hoffman [34] adaptability is the capacity of a work system to achieve its goals, despite the emergence of circumstances that perturb it from a predetermined course by pushing it toward the boundaries of its competence envelope. There is a very fine line between resilience and adaptability, while resilience involves stability, adaptively implies change [34] Hosseini et al. [2] refers to adaptive capacity as the degree to which a system is able to adapt itself temporarily to new disrupted conditions.

Adaptability is an essential building block of resilience especially in relation to the introduction of technologies for teaching and learning in rural communities. However, resilience literature refers to adaptability as a post-trauma exercise, that is, you experience a shock and learn to adapt while trying to get back to the pre-trauma condition. This is a very narrow view of adaptability as it implies that adaptability as an element of resilience is associated with dealing with changing from good to bad. The introduction of technologies for teaching and learning in rural communities may impose challenges to those that have to receive and use them. The level of preparedness or the state of readiness for these contexts is dependent on previous exposure to ICT, the lesser the exposure the more the challenge and a need to adapt to using technologies. Adaptability in this sense is not going from good to bad, but moving from less empowered to being empowered. The importance of adaptability in this

sense is that it speaks to the level of disruption which technology brings and how the recipients adapt to new ways of teaching using technologies.

5   Overview on the use of mobile technology in resource constrained schools

There has been, over the past years a great progress in the use of technology in resource constrained schools in South Africa. The reason for introducing technologies was to deal with number of problems which amongst them included lack of resources (libraries and laboratories), the textbooks crisis in South Africa, and many other problems like teachers with little capacity to teach and shortage of teachers at schools. The CSIR in South Africa has, over the years been involved in the research of the introduction of technologies in rural schools. The research has been done in partnership with other government departments like the Department of Science and Technology, The Department of Rural Development and Land Reform, Department of Education, National Education Collaboration Trust and other organizations. Over the years there has been a great focus on the sustainable introduction of technologies at schools which emphasized the importance of teacher development as a critical element for introducing technologies to school in a sustainable way [20,25,26,32] Another development made in research on this domain is the conceptualization of a school in an ecosystem. This view takes the precept that one cannot understand the school outside the context through which it is found. Conceptualizing the school in this way has highlighted a sense of what needs to happen at various levels of the ecosystem (school, SMT, SGB, teachers and the community) to ensure an effective introduction of technologies in a way that not only introduces the technology at the school, but revolutionaries the way of teaching and learning using technologies [20]. Further research is to be commissioned on how schools can be made resilient, that is, they become self-reliant in sustaining technology implementation despite the gradual decay of the education system in South Africa.

6   Identifying the main aspects relevant in defining community resilience for a SA context

The following table summarizes the essential aspects and concepts to consider if defining community resilience for the South African resource constrained context when implementing ICT in rural schools.

Concept	Aspects to consider within concepts	Authors (from 17 selected articles)
Resilience	Bounce back Withstand Mitigate Robustness Self-organisation and learning	[2,49] [3-6] [1,2,7-9] [35]
Community resilience	Adapt to outside pressures Capacity development or change Beyond boundaries Absorb impacts Geospatial Improving knowledge and health of community Community support and ability to interpret the environment, intervene, and move o The existence, development and engagement of community resources by community members who intentionally develop personal and collective capacity to respond to and influence change, to sustain and renew the community, and to develop new trajectories for the communities 'future.	[4,5;27-28] [24] [24] [13] [1] [27] [2] [30]
Adaptiveness/adaptability or capacity to adapt to change	Creative problem solving, coping with uncertainty, learning new tasks and skills, adapting to teamwork and collaboration, changing procedures and developing new procedures, and adapting across cultures Adapt to new disruptive conditions Learn from and respond to changes precipitated by some hazard event.	[11-13] [2,34] [14]

Social capital or constructs	Social cohesion of individual, household and community Success of individual – success of community – collectiveness	[2,27]
Within a system/ecosystem	To withstand shock Socio-ecological approach which is being able to absorb disturbances while remaining within a "normal" or acceptable state; (ii) capacity to self-organise; and (iii) being able to build capacity for learning and adaptation.	[26,27,31] [29]
Access and use if technology in resource constrained environments/rural schools	To resources like ICTs Improving knowledge and adapt to change of using technology sustainably	[2,20,25,26,32]

This table result in three possible working definitions of community resilience which are:

- the ability of the ecosystem at local level of the community to maintain its characteristics and performance in the face of contextual shocks and fluctuations and self-organize and build capacity;
- ability of the system to independently rearrange or adapt its functions and processes in the face of an external disturbance that can result in social cohesiveness, without being forced by the influence of other external drivers, and
- capacity of the system to generate feedback with which to gain or create knowledge, learn and strengthen skills and capacities necessary to experiment and innovate to disruptive technologies.

If the essence of the table had to be summarized with Wordle the following would have emerged:

Figure 1: Wordle of summarizing essential aspects of the definition of community resilience for South Africa in resource constrained environments

7   Conclusion

The increasing complexity in how resilience is perceived, defined and used makes it practically impossible to come up with a universal accepted definition of the term. Despite the absence of the universal agreed definition, there are number of elements which many scholars have identified as crucial when working with the concept. There are also numerous frameworks which have been proposed by many scholars and each deal with resilience in a different context. This paper has worked with the notion of community resilience which is one of the frameworks for measuring resilience. The paper adopted scoping literature review on articles related to resilience and has identified three elements which should form the building blocks of the South African theory of resilience. The three identified elements are system/ecosystem perspective, community resilience and adaptive/adaptability. The paper has highlighted how it is impossible to speak about resilience without looking at a system or an ecosystem which is an indication that resilience is measured at a system level. The community resilience system has indicated how the individual, the household and the family for the ecosystem through which resilience can be measured based on the roles which each unit plays. The paper has also indicated that adaptability can happen without trauma as resilience in some context does not refer to an event that happens at one time, some occurrence are gradual, like the continuous decay of the education system in South African rural schools. The end goal is to

make policy recommendations to all stakeholders with guidelines on adopting and implementing community resilience frameworks to support resource constrained communities in South Africa.

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Migrant Workers' Use of ICTs in Unacceptable Forms of Work

Hannah Thinyane✉[1][https://orcid.org/0000-0003-0491-4048], Karthik Bhat[2][https://orcid.org/0000-0003-0544-6303],

Don Junio[3][https://orcid.org/0000-0001-6733-0635], Bei Ju[4][https://orcid.org/0000-0001-8324-9001], Catriona Craven-Matthews[5][https://orcid.org/0000-0001-5074-8461]

United Nations University, Institute on Computing and Society. Macau SAR, China
{hannah, ksbhat, djunio, jennyju, catriona}@unu.edu

Abstract. Human migration and displacement have emerged as key global challenges of the century. While the debates continue on the positive and negative consequences of migration, what is certain is that large numbers of workers migrate and serve as a source of cheap, low-skilled, and flexible labour for wealthier countries. In doing so they fill the '3-D' jobs (dangerous, dirty or degrading) that national workers refuse to take. To understand how the International Labor Organization's (ILO's) concept of 'decent work' can be achieved for migrant workers, we propose to critically analyze what is not 'decent work' (defined by ILO as Unacceptable Forms of Work, UFW), and how migrant workers can use Information and Communication Technologies (ICTs) to improve their situation. This paper introduces four projects that we are currently undertaking with different migrant worker communities across East Asia, investigating the use of ICTs to empower migrant workers across the spectrum of Unacceptable Forms of Work. More specifically, this paper critically analyzes how migrant workers can use ICTs to support their structural empowerment, human dignity, and physical integrity. The paper shows that ICTs can contribute to the self-empowerment of migrant workers by providing them with the space and tools to adapt to their new environment, develop new skills, and access relevant information. ICTs can also empower migrant workers to exercise their agency when confronted with exploitative work conditions, contributing positively to their physical integrity and human dignity. In the same vein, ICT training can improve the psychosocial well-being of migrant workers, particularly victims of sex trafficking, through improved self-esteem and self-worth. This paper draws together the approaches, outcomes and policy implications of each of these case studies to present locally relevant, practical, theoretical, and methodological contributions in deepening our understanding of how ICTs can improve the condition of migrant workers in UFW.

Keywords: Unacceptable forms of work, labour exploitation, migrant workers, ICTs.

1   Introduction

Over the last decades we have seen a large increase in international and internal migration, with almost half of all international migrants being economically active. These workers often move from low-income to middle and upper-income countries in order to provide for their families and escape poverty, war, or natural disasters in their country of origin [1]. These workers are often forced to fill '3-D' jobs (dangerous, dirty or degrading), serving as a source of cheap, low-skilled, and flexible labour that national workers refuse to take [2].

Goal 8 of the Sustainable Development Goals (SDGs) aims to promote sustained, inclusive, and sustainable economic growth; full and productive employment; and decent work for all. The targets for this goal include promoting decent work for all (8.5), with specific mention to eradicating forced labour, modern slavery and human trafficking (8.7); and protecting labour rights and promoting safe and secure working environments (8.8). The targets specifically call for labour rights to be protected for migrant workers, particularly women migrants and those in precarious employment (8.5). SDG 8 draws on International Labour Organization's (ILO's) definition of decent work as "productive work under conditions of freedom, equity, security, dignity, in which rights are protected and adequate remuneration and social coverage is provided" [3] (p. 15). The ILO defines situations that are not decent work as unacceptable forms of work (UFW) as those that: deny fundamental principles and rights; put lives, health, freedom, human dignity, security of workers at risk; and keep households in conditions of poverty [4].

This paper describes the work that we are currently undertaking as part of the Migrant Technology project at United Nations University, Institute on Computing and Society. This research is premised on investigating how migrant workers in UFW can use technology to enhance their situated agency and change their overall conditions. As will be illustrated in the next section, these UFW can range in severity from more benign forms of exploitation such as unfair recruitment policies to severe cases such as forced labour. This paper introduces four projects that we are currently undertaking with different migrant worker communities across South East Asia: pre/post recruitment of domestic workers from Philippines; Security guards and cleaners who migrate daily from

mainland China to Macau; workers in situations of labour exploitation and human trafficking in Thailand; and sex trafficking survivors in Philippines. It then discusses the locally relevant practical, theoretical, and methodological contributions we are making to understand how relevant stakeholders make sense of how ICTs can improve migrants' working conditions.

2   ICTs and Unacceptable Forms of Work

Our analytical framework draws on existing literature on UFW. In this context, we characterize ICTs as tools that can support migrant workers across the spectrum of UFW. We use Empower Foundation's definition of UFW as consisting of work environments where there are violations of: structural empowerment; human dignity; physical integrity [5] (p. 19). In our four projects, we investigate the use of ICTs and how it empowers migrant workers across their migration cycle, along these three factors. We combine them with Skřivánková's continuum of exploitation [6] to illustrate the varied forms and severity that exploitation can take within the workplace (Fig 1). In this figure, 'decent work' and 'forced labour' are depicted as the two extremes of the continuum, and the situations between the two (as well as forced labour itself) represent different UFW. These range from, on the left, more benign forms of labour violations such as discrimination and payment under minimum wage to, on the right, more exploitative acts that lead to forced labour. The remainder of this section introduces the factors of structural empowerment, human dignity and physical integrity. We then highlight some ICTs that are being used by migrant workers to improve their situation.

Structural empowerment is defined as how the work environment nurtures or obstructs the self empowerment of workers. Empower Foundation suggests that it can be assessed by understanding: workload demands placed on employees; resources provided to employees so they can effectively and safely do their job; the degree of control or autonomy provided to employees; the recognition of employees' contributions; the quality of social interactions or community at work; respect for and consideration of the workers' rights; and sense of shared values and priorities between workers and management [5] (p. 69). There are a wide range of tools that exist to enable workers to rate and review recruitment agencies, including Contratados in US /Mexico[7], Migrant Recruitment Advisor in Southeast Asia, and Pantau Pjtki in Indonesia [8]. These platforms support migrant workers' structural empowerment by providing access to: ratings and reviews of recruitment agencies and employers; and country specific labour laws. Other tools such as HourVoice [9] and Outflank [10] allow workers to track their hours and estimate their wages (including overtime rates, allowances, deductions, and break conditions) in order to check if they are being paid correctly.
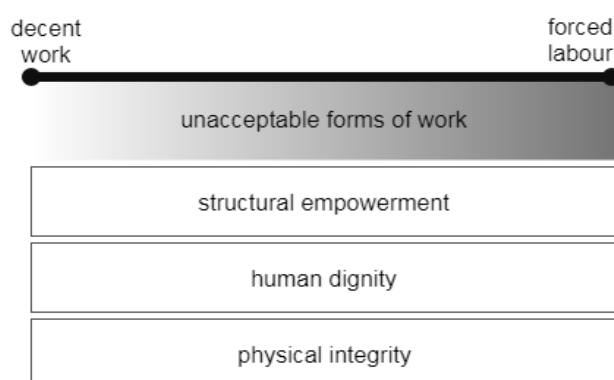

Fig. 1: Continuum of exploitation and unacceptable forms of work. Adapted from [6]

Drawing on Buchanan's reflection on human dignity and the central role that it plays in human rights discourse, we define the term using what he refers to as 'a basic minimum core' of [11, pp. 686–694]:

- Prohibition of all types of inhuman treatment, humiliation or degradation by one person over another
- Individual choice and the conditions for self-fulfillment, autonomy, and self-realization
- Protection of group identity and culture
- Creation of the necessary conditions for individuals to have essential needs satisfied

Physical integrity (or bodily integrity, using political theorist Martha Nussbaum's terminology) can be defined as "being able to move freely from place to place; being able to be secure against violent assault, including sexual assault" [12] (p. 41). This definition highlights the importance of autonomy and self determination. When applied to a work environment, physical integrity also includes both an employer's responsibility for a safe and

healthy work environment, as well as a state's responsibility for creating structures to honor and protect the physical integrity of the worker.

We recognize the interrelationship between the factors of human dignity and physical integrity, so although initially proposed as separate factors [5], in this paper we merge our discussions and present them as one. We begin this discussion by considering ICTs that support peer-to-peer connections amongst groups, in order to support group identity. Many migrant worker groups form informal online communities of support using popular social media channels. Komito describes the use of social media as a "virtual community 2.0" for migrants to form new connections, as well as passively monitor others in a 'dispersed community of affinity' [13] (p. 1075). Other groups such as OFW Watch provide applications that integrate into workers' social media channels. This app monitors online activity and sends emergency updates to pre-selected contacts if the worker becomes inactive on social media for a period of time.

Another group of tools aim to provide workers with anonymous access to complaint and grievance mechanisms [14], as well as gathering evidence of abuse. A common problem with reporting cases of abuse is being unable to prove the authenticity of the claim. EyeWitness to Atrocities is a system developed with the International Bar Association to allow witnesses of crimes to capture and send images and videos in a way that they can be used in court, by creating a trusted chain of custody record [15]. The app also has a 'panic button' that allows the witness to protect themselves and delete any information, as well as the app itself, from the phone in case it is examined by perpetrators or other hostile people.

This section has defined UFWs, and provided illustrations of how migrant workers are using ICTs to support their structural empowerment, human dignity and physical integrity. The next section introduces Sen's capability approach, the theoretical framework that this work is based upon.

3   Theoretical Framing

In his book *Development as Freedom*, Sen explores the relationship between development and freedom, arguing that the expansion of human freedom should be viewed "as the primary end and the principle means of development" [16] (p. xii). He defines development as "the ability – the substantive freedom – of people to lead the lives they have reason to value and to enhance the real choices they have" and of removing "unfreedoms" such as poverty and inequality [16] (p. 293). The capability approach operates at a number of different levels, or as stressed by Sen, it was designed to have relevance for a "plurality of purposes" [17] (p. 49): "as a framework of thought, as a critique on other approaches to welfare evaluations, and as a formula to make interpersonal comparisons of welfare" [18] (p. 3).

Sen defines the concept of agency as "the realization of goals and values she has reasons to pursue, whether or not they are connected with her own well-being" [19] (p. 56). Importantly, agency includes both the achievement of goals as well as the freedom to achieve them. This freedom of agency is constrained by a number of factors, including social, political and economic opportunities. In his definition, Sen distinguishes between well-being and agency, providing a space for the discussion of the pursuit of a goal that may in turn result in the sacrifice of health, friends, and in some cases, the individual's own life [20].

Due to the open-ended nature of Sen's Capability Approach, there is little explicit discussion about the role that technology can play in development. If we simply use the approach as a 'framework of thought', we see that the fundamental principle of technological development should be to enhance substantive freedom, or people's capability to lead the lives they have reason to value, and to enhance the real choices they have. This speaks of the use of ICTs as a means to an end, rather than as the end in itself. Some scholars have applied the capability approach superficially, and view technology as a commodity or a resource [21]. Feenberg suggests a much deeper understanding of the interplay between technology, society, beliefs and values [22], an idea that is echoed by a number of scholars.

Sen is implicitly concerned with power relations and unjust social structures, but doesn't provide any specific mention of how to understand and interpret these factors. Due to the open-endedness of the Capability Approach, it can be complemented with other theories that have strengths in this area. Critical Theory focuses on determining obstacles to freedom, at both a social and individual level, with "a rich theoretical repertoire in relation to the constraints and boundedness of human agency" [23] (p. 74). Zheng and Stahl note the similarities between the two theoretical approaches, showing how Critical Theory can complement and strengthen the Capability Approach [23] (p. 73). Zheng and Stahl suggest the definition of *situated agency*, drawing from Critical Theories concepts of ideologies and hegemony, as a concept that expresses the idea that agency is "not only a product of specific socio-historical settings, but also situated in a sometimes invisible or taken-for-granted network of ideology, and participate[s] in the production and reproduction of these socio-historical structures and ideological tenets" [23] (p. 75).

Drawing from this definition of situated agency, this research therefore aims to unpack the capabilities that technology can contribute to migrant workers, and under what conditions and with what enabling factors / barriers this can occur. Central to this research is the focus on migrant workers in UFWs and enhancing their substantive freedom. Technology usage therefore, is always considered a means to an end rather than an end in itself. Drawing on Sen's definition of agency to include the pursuit of a goal that is in contrast to a person's own well-being, a guiding principle of our research is the importance of people retaining power to make their own decisions.

The next sections describe each of the four projects that currently make up the empowering migrant workers with ICTs research theme. Each project focuses on different parts of the migration journey, from pre/post recruitment, to travel and transit, to work, to integration post-exploitation. Each project employs different research methodologies, theorizations, and research questions specific to the contexts and studied populations of the project. While each of these projects is substantial enough to be described in a paper of its own, the aim of these sections is to provide only enough background to support a substantive discussion in Section 8 of the locally relevant practical, theoretical, and methodological contributions we are making to understand how relevant stakeholders make sense of how ICTs can improve the condition of migrant workers by enhancing their situated agency.

4 ICTs in Pre/Post Recruitment of Foreign Domestic Workers

The risks and problems that prospective migrant workers experience begin at the first step of their migration journey. At the recruitment stage, migrant workers are already at risk of human trafficking and forced labour in the hands of exploitative recruitment brokers. The types of abuse that prospective migrant workers may face vary in nature and severity from collection of illegal recruitment fees and impounding of passports, to debt bondage linked to recruitment fees and even threats of violence if workers leave their employer. With the rise in use of modern ICTs, existing activities such as recruitment of migrant workers and their underlying social structures, relational dynamics, and internal logic are being disrupted. In this regard, understanding this process of disruption would allow us to derive better insights on the information lives of migrant workers.

This project examines (i) the ways ICTs empower Foreign Domestic Workers (FDWs), in particular during the pre/post recruitment stages of their migration journey and (ii) the inter-relationship of migration governance and ICTs. Countries of interest include major migrant sending countries such as the Philippines and migrant receiving destinations including Singapore, Hong Kong and Macau. In broad terms, this study aims to address the following research questions: what is the role of ICTs in pre/post recruitment of FDWs and how can ICTs

Using an Appreciative Inquiry framework, this project seeks to uncover pernicious problems FDWs routinely face, and determine how ICTs can empower them by enhancing their situated agency and physical integrity. Taking a qualitative case study approach, the research will employ ethnographic interviews of foreign domestic workers and relevant stakeholders and surveys to answer the research question propounded. Secondary sources will complement our primary data collection activities. Partnership and collaboration with NGOs in labour sending and receiving countries also forms part of our research design to understand the local contexts.

5 Social Media Usage of Dual Migrants in Border Crossing

This project investigates the use of ICT, in particular social media, in the cross-border life of low-skilled mainland Chinese dual migrants. "Dual migrants" are individuals who have left family and friends in other provinces of China and moved to Zhuhai, and migrate daily across a regulated, political border. In this particular study, the border lies between Zhuhai (in mainland for housing) and Macau (for work). These mainland Chinese dual migrants work against time every day. Though they don't have time for leisure, such as consuming mass media, social media plays a contributive role in their mobilized life via portability and accessibility.

This study explores the perceived affordances of social media (WeChat, the most popular social networking service, SNS, in China) in the cross-border life of mainland Chinese dual migrants in Macau, China. We recruited 24 low-skilled mainland Chinese dual migrants (13 male security guards; 11 female cleaners) to participate in in-depth interviews, group discussions, and WeChat conversations. These sessions revealed that mainland Chinese dual migrants, on the one hand, are found to be in vulnerable conditions suffering precarity, loneliness, discrimination, and toil in cross-border life. They are isolated from local society and they are also labeled as outsiders due to their occupation, language, and place discrimination. Thus, the "mainlander" has become their stigmatized identity in Macau. On the other hand, they desire for digital empowerment and online adaptation built upon their structured agency (e.g., not well-educated and low-skilled). WeChat is perceived as a

digital mediated space affording solidarity, conviviality, cognizance, and monetisation. In terms of structural empowerment, dual migrants enjoyably seek for online support from bonding and maintaining social capital, and to access information related to border migration policy, and their new host environment.

However, ICTs do not always serve to support the migrant workers. WeChat also turns out to be a digital panopticon, monitoring workers' punctuality and work performance. Although WeChat is a virtual space for pleasure and entertainment, it has proved itself to be unviable for dual migrants to report exploitation and unfair treatment.

6   Apprise: Identifying Exploitation of Migrant Workers

Thailand, one of the largest economies in the Mekong sub-region, is hailed as the land of opportunities by those living in the neighboring Laos, Myanmar and Cambodia [24]. Its rapid urbanisation has generated a constant demand for cheap labour which is met by workers migrating to urban and semi-urban Thailand from its neighboring countries or from rural Thailand. This labour market context gives rise to a conducive environment for exploitative working conditions.

The extent of the problem related to human trafficking and forced labour is clouded by the lack of reliable data on the number of victims. The most conservative estimates of forced labour and human trafficking statistics indicate that there are almost 21 million people in situations of forced labour or human trafficking worldwide [25], with a large number of these being migrant workers [26, 27]. The US State Department's 2017 Trafficking in Persons Report illustrates that in 2017, only 0.3% of the total estimated victims were identified (66,520 people) [28]. These exploitative work situations are able to exist due to a number of reasons, including poor regulation and enforcement of labour standards across the labour market. Local and federal police, as well as labour inspectors, are tasked with the role of ensuring that cases of labour exploitation are firstly identified and then dealt with (typically using penalties for exploiters and recompense for victims). In Thailand, the state actors (local and federal police, labour inspectors) work with non-state partners including social workers, inter-governmental organizations, and non-governmental organizations to assess working conditions, and to help potential victims become aware of and gain access to social services, complaint mechanism, and support (for example emergency shelters, legal representation). In this paper we refer to these state and non-state actors collectively as frontline responders.

Our research questions attempt to unpack the problems faced by the frontline responders in identifying potential victims, and if and how technology could assist in this process. To do so, we undertook four consultation sessions with over 100 stakeholders representing: migrant workers in vulnerable situations; local and regional NGOs; Thai Government; Royal Thai Navy; regional embassies; and inter-governmental institutions. The first of these sessions aimed to understand the problems that frontline responders currently face in identifying victims, and how they believe ICTs can be used to support this process.

We identified the major problems Thai frontline responders encounter in their identification process: privacy, trust, training, and communication. A further outcome from these sessions was the collaborative design of a simple mobile phone application on a frontline responder's phone, to allow them to ask questions in different languages to potential victims. The multilingual questions directly targeted the specific issues faced by the Thai frontline responders who were not conversationally proficient in the various languages of the neighboring countries. This mobile application would also be primarily audio-based, further aiding communication, as well as enabling communication with semi-literate or illiterate users. At the same time, the application was designed to ensure privacy of responses which are collected only as "yes" or "no" responses (by selecting between icons on a screen).

With the proposed design in place, the subsequent sessions with legal experts, government officials, and frontline responders were spent crafting questions based on key indicators and proxy indicators of vulnerability. The question lists was crafted using a modified Delphi technique to bring out a consensus drawing from the multiple perspectives held by these stakeholders, combining both a top-down and bottom-up approach. The questions lists were aligned to Thai legal frameworks (labour law and anti human trafficking laws) to ensure that the calculation of vulnerability had a legal basis. At the same time, the inputs from frontline responders were also included to ensure that we mirrored the more rapidly changing practices of exploiters (witnessed by these responders).

As an outcome of these four sessions, we have developed four sector-based lists of exploitation (fishing - at port or at sea, processing and manufacturing, sexual exploitation, forced begging). The questions have been assigned a "weight" that signifies the strength of the vulnerability it is associated with. The weighting system is adapted from the methodology proposed by ILO in their Hard to See, Harder to Count methodology for identifying cases of human trafficking and forced labour [29]. This is then used to provide preliminary indications about a worker's situation to the frontline responder. Currently, many cases of exploitation slip through the cracks due to

insufficient communication skills, questioning and lack of training in the pre-screening phase of victim identification. With the more objective perspective introduced by this application, we introduce a mechanism to determine the need to further communicate with workers who indicate that they are being exploited, and/or want the frontline responder's help to leave their current situation.

7 ICT Skills Training for Survivors of Sexual Exploitation

One of biggest concerns of trafficking survivors is what they will do when they leave the immediate post-trafficking service provider [30]. Economic and financial factors are often main motivations in the decision to migrate in the first place, and survivors are similarly concerned about how they will make a living post-trafficking [31] (p. 3). Although aftercare organizations commonly provide vocational training programs, many of these are very limited, gendered training options (such as cooking, knitting, or sewing), vocational training that are not relevant to local job markets in survivors' home communities [32], or vocational training without access to actual employment opportunities because of lack of linkages to businesses [33]. When inadequate employment options are provided to trafficked persons after their exit from human trafficking, survivors may experience worse financial difficulties than before they were trafficked and be vulnerable to re-exploitation [14]. This research proposes to contribute to the understanding of technology-based training in the post-trafficking stage by partnering with a local social enterprise (SE) in the Philippines that provides ICT-based training, core skills training, and employment to survivors of exploitation and abuse. Specifically, the project investigates the impact of digital skills training on the psychosocial well-being as well as the self-concept of the survivors. It also asks how the training program and the security of high-skilled employment affect recovery and reintegration. For those employees in particular who are survivors of online sexual exploitation, or for whom ICTs played a key role in their trafficking experience, the training/work offers the possibility of the 'redemption of technology'- an opportunity for them to use ICTs to enhance their structural empowerment, human dignity, and physical integrity, rather than ICTs being used as a means of exploitation.

This project uses a participatory video methodology, in which 13 survivors employed at the Philippines SE learned to produce and edit videos over the course of six two-hour workshops. They created short videos about their experiences with the SE's training program. Semi-structured interviews were also conducted with the 13 participants plus the seven senior managers of the SE.

The research aims to produce knowledge and policy implications regarding the use of ICTs by practitioners to support structural empowerment, human dignity, and physical integrity during the post-trafficking/reintegration phase to improve the human condition of survivors. Through continuous provision of services, an intentionally supportive workplace, and well-paid employment, the SE creates an environment that nurtures the structural empowerment of employees. Additionally, their human dignity and physical integrity may be enhanced by the opportunity afforded by their acquired tech skills. These skills allow them to engage in decent work in a safe environment, free from exploitation and risk of violence. In this case, it is not the ICTs or ICT skills themselves that are crucial for reintegration; rather, the opportunities afforded by the ICT skills enable survivors to enhance both their situated agency and well-being through access to highly-skilled employment that is usually unattainable for survivors of trafficking. Therefore through ICT-based employment, survivors can potentially increase their own capabilities and well-being within the social, political, and economic constraints in their home country setting from which they were exploited in the first place. This research will particularly examine the impact on efficacy-based self-esteem [34] of highly-skilled, non-gendered work, and the consequent effect on well-being.

8 Discussion

This section draws together the contributions made by each of the separate projects, discussing them along the themes of structural empowerment, human dignity, and physical integrity. As the factors of human dignity and physical integrity have proved to be interlinked, we will discuss them together. Table 1 provides an overview of the findings that we have derived to date, in our critical analysis of the use of ICTs to empower migrant workers in unacceptable forms of work. Across each of these factors, the following subsections discuss how relevant stakeholders (for example politicians, NGOs, scholars, and citizens) make sense of how ICTs can be used to improve the human conditions of migrant workers.

Table 1: Use of ICTs for structural empowerment, human dignity & physical integrity

	Structural Empowerment	Human Dignity & Physical Integrity
FDW Recruitment	access to information	
Mainland Chinese Dual Migrants	online adaptation	
Apprise		access to information ability to request help to leave situation support autonomy of migrant worker
ICT skills for exploitation survivors	skills development	impact of ICT training on self-esteem, self-worth 'redemption of technology'

8.1 Structural Empowerment

Through our different projects, we have identified various ways ICTs are able to contribute to the structural empowerment of migrant workers and exploitation survivors. In our study looking at mainland Chinese dual migrants, we observe how social media, WeChat in particular, provides the space for dual migrants to seek meaningful connections including online support and solidarity, entertainment, and information gathering and sharing. In other words, ICTs help dual migrants overcome their physical isolation by providing them with the tools to adapt (online adaptation) to their new environment.

ICTs have the potential to improve the economic realities of vulnerable and exploited people including survivors of sex trafficking. Technology-based training goes beyond the usual gendered interventions and skills training that often do not provide sufficient and sustainable income. Beyond the potential psychosocial benefits of using participatory video, this approach allows us to support the trafficked victims with value-added skills such as video editing and storyboarding that they will be able to use in their workplace. Such skills can provide them with higher earning potential beyond the other technical skills that they have already acquired in the ecosystem of the SE which they are a part of.

In addition to providing new skills and a space for online adaptation, we have found that ICTs are also able to empower migrant workers and vulnerable people by helping bridge the information gap, enabling them to correct information asymmetry that is crucial in allowing them to make better and informed choices. Our planned research examining the information lives of Foreign Domestic Workers pre and post recruitment seeks to provide grounded bottom-up feedback on the ways ICTs are impacting their lives. By focusing on three locations, we seek to unpack the ways use of ICTs are shaped or are being shaped by the contextual environment of FDWs.

These three activities have provided theoretical and practical contributions for ICTD studies. The dual migrant activity has shown that mass-media based cross-cultural adaptation theories fail to elucidate the effects of communication via a digitized platform. In this case, their social networking site practices such as involvement with other mainlanders and learning about their new environment are examples of newcomers' initiative adaptation. In other words, their ICT usage has provided a novel approach to exploring adaptation. However, in conceptualization of the term adaptation, current theories have not been able to systematically connect linkages across online and offline spaces. Using the concept of situated agency, dual migrants' adaptation is impacted by structural forces and power in society, as well as newcomers' individualized agency. Those migrants' structured agency such as low-skilled labor migrants with low social status in Macau, indicates the impossibility of their integration. In addition, their coping strategy, that is their physical isolation and online adaptation, reflects that the newcomers as agents do preserve the power to actively choose how to, and to what extent they adapt.

The recruitment project and training of exploitation survivors project give us more practical insights. In terms of recruitment, it targets FDWs situated in a variety of contexts, such as Singapore, Hong Kong, and Macau.

In each case, FDWs have their own structured agency in variation with political, economic and social-cultural conditions, which may impact their use of ICTs to seek and share information, work, and their integration strategies in the host environment. In this sense, the ICT interventions could be adapted to suit the specific context of the ICT users. In terms of exploitation survivors, ICT-relevant training courses help them develop the skills which are transferable in their future work. More importantly however, that their use of ICTs that was once used for exploitation can instead be a instrument of empowerment. In a sense, the skills learnt will provide them with more freedom and capabilities in the future life

A grounded approach is used across each of our projects, informed by a bottom-up strategy of identifying various ways ICTs are able to contribute to different vulnerable groups. Knowledge generated from our approach could provide valuable inputs to policy makers, NGOs, and other relevant stakeholders and help them make informed decisions rooted in local contexts. Integral to our different projects is a conscious effort to partner with local stakeholders to co-create solutions and tackle issues that they have identified in a way that urge these local stakeholders to take ownership of the contextualized problems and the solutions moving forward.

8.2   Human Dignity and Physical Integrity

The concepts of human dignity and physical integrity assert the autonomy humans have over themselves, and the right to be respected as humans. In cases of human trafficking, forced labour, and labour exploitation one or both of these inherent rights have been abused. In our work, we aim to empower workers in these exploitative conditions as well as post-exploitation, during their reintegration to society.

With Apprise, we attempt to assist workers in exploitative situations (forced labour, sexual exploitation, forced begging) to empower themselves, exercise their agency, and take control of their situation. Many people in exploitative work conditions are there involuntarily: either kept there by force, with threats of physical violence or debt bondage, or by cultural factors like the shame associated with being abused. Many others, on the other hand, are knowingly in such situations due to reasons like financial hardship. By providing workers with access to information about the situation they are in, based on their responses to our questions, we provide an objective assessment of the vulnerability of their situation according to the Thai legal framework. Crucial to the situated agency of the worker is the final question of the assessment, 'Do you want to leave?' By providing them the ability to express their desire to leave their exploitative job after being informed of the severity of their vulnerability-- and to actually leave the situation with the frontline responder--we empower them to exercise their agency and physical integrity to take steps to better their situation. On the other hand, recalling Sen's [20] distinction between well-being and agency, we recognize that a worker in a UFW may not want to leave the situation. By giving the worker themselves the freedom to make that choice after providing them with information, we preserve their situated agency.

This project investigates and invents ICTs that enable migrant workers in UFW to identify themselves to frontline responders and enhance their working conditions. The involvement of various stakeholders from Thailand (Ministry of labour, Ministry of Justice, Ministry of Social Development and Human Security, local NGOs, and rehabilitated survivors of exploitation) firmly grounds our research and design in the specific Thai context. The question lists created with, and critiqued by, Thai legal experts enable this research to enhance the current process of victim identification in Thailand. Apprise also aims to inform policy and best practices for identification of victims of trafficking and forced labour in Thailand, as a long term outcome. Current practices are found to be lacking in many aspects, leading to significant under-identification of victims [24]. With the findings from this research, we aim to inform government policy on potential ways to improve the current methods as well as potential pitfalls to avoid.

Another project of our research focuses on the post-exploitation stage, where the survivors of sexual exploitation are supported with ICT skills training to learn marketable skills enabling better futures. ICT skills and ICT-based employment greatly enhance the capabilities of survivors, through a higher income, access to holistic support, and the possibility of a career. These skills also serve a dual purpose of allowing for what we refer to as 'technology redeemed': introducing and teaching the positive sides of the very technology that may have been used to exploit them in the past. Through this process, their human dignity and physical integrity may be enhanced by the opportunity afforded by tech skills to engage in decent work in a safe environment, free from exploitation and risk of violence, along with the ability to satisfy their own needs and exercise agency in their life. Although the survivors have returned and are reintegrating back into their home communities, facing many of the same socioeconomic structures and conditions that led to their vulnerability to trafficking in the first place, their capabilities are enhanced, and they have the agency to improve their own well-being, within those limiting structures.

This activity also proposes to contribute to locally relevant methodology by making use of a participatory video approach. Survivors took part in a two-week participatory video workshop in which they produce self-

reflexive films about their experiences with the training program. Practitioners of this form of participatory action research find the iterative process of filming, editing, and screening to be a means for empowerment for disadvantaged/marginalized groups and a tool for social change through positive self-reflection and collective analysis [35]. The films that participants produced provide insight into how they experience the organization's use of ICTs for employment to improve their condition. The participatory video method avoids extractive methods that benefit only the researcher, while allowing for a breakdown of the traditional hierarchical relationship between researcher and research subject.

9 Conclusion

This paper has presented four projects that we are currently undertaking across East Asia to understand how migrant workers use ICTS while in UFW: pre/post recruitment of domestic workers from Philippines; Security guards and cleaners who migrate daily from mainland China to Macau; workers in situations of labour exploitation and human trafficking in Thailand; and sex trafficking survivors in Philippines. It has presented a critical analysis of the use of ICTs to support migrant workers in their structural empowerment, human dignity and physical integrity. In doing so it has discussed the locally relevant practical, theoretical, and methodological contributions that we are making to help a wide variety of stakeholders understand how ICTs can be used to empower migrant workers.

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Data

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Sunet Eybers

University of Pretoria, South Africa

How Can South Africa Harness the Data Revolution to Measure and Monitor Its Progress towards the SDGs?

Jean-Paul Van Belle[1] [0000-0002-9140-0143]

[1] University of Cape Town, Cape Town, South Africa
jean-paul.vanbelle@uct.ac.za

Abstract. The 17 Sustainable Development Goals (SDGs), which were agreed to by all Africa's UN members, set an ambitious roadmap to achieve development in Africa in the next 12 years. Achieving these SDGs will entail gathering huge amounts of data in order to provide the baselines for, and ongoing monitoring of its 169 targets and 230 indicators. This paper takes a high-level view at the South African data ecosystem in order to identify the opportunities offered by emerging data gathering technologies and new paradigms and investigate how they could be used to reduce the high-level gaps in terms of measuring the key SDG indicators. The study was conducted using a document analysis of publicly available information as well as a few interviews. Although South Africa is currently in a relatively strong position to provide the core data compared to the rest of Africa, recommendations are made in respect of the many gaps still remaining.

Keywords: Sustainable Development Goals (SDGs), Data Revolution, South Africa, National Statistics, Data-for-Development (D4D), Big Data.

1 Introduction

The Sustainable Development Goals (SDGs), as adopted in September 2015 by the United Nations (UN) General Assembly, provides a fifteen-year roadmap and agenda to ensure social, economic and environmentally sustainable development across the world [1]. The SDGs have been aligned to and mapped onto regional strategies, such as the Agenda 2063 for Africa (through the Common African Position) [2,3] and national development plans (NDPs), such as the South African NDP [4,5]. However, achieving the vision and the concordant commitments of the 17 listed SDGs requires baseline data and ongoing monitoring of progress across the 169 targets and 230 indicators which the member nations agreed upon [6]. Given that not even the most developed nations are currently able to address the data challenge posed by the SDGs fully [7], it is imperative that an assessment of the data capabilities of African countries is made [8]. Indeed, the African leaders, through the African Union and its associated organs, have already embarked on the process of strategizing the strengthening of continent's statistical capabilities. This is reflected in the Strategy for the Harmonisation of Statistics in Africa (SHaSA), the Young African Statistics (YAS) initiative and the design of a Minimum Statistical Programme for Africa which would combine surveys, censuses, administrative records and secondary data sources.

The technical complexities of the details, the many vested interests of multiple players, the politicization of the debate, the different viewpoints and worldviews of the many stakeholders, good governance, and recent technological developments, postulate the need of independent third-party assessments of how and to what extent, the SDG data requirements can be met at the national level. This need for an independent, high-level assessment of the readiness of selected African countries motivated the current research. This paper looks at the South African context in particular to assess the readiness of various actors within the data ecosystem to provide the required data.

More specifically, this paper seeks to address the following objectives:
(1)   To assess current information sources and emerging data technologies, often referred to as "the data revolution", that could address the data needs posed by the SDGs;
(2)   To identify the biggest gaps in terms of sources, capabilities and dynamics for baselining and measuring the SDGs (the focus will be on the first five SDGs);
(3)   Make achievable high-level recommendations as to how some of these gaps could be addressed.

These objectives have been addressed through a short-term desktop research project. The ultimate aim was to investigate alternative data sources and collection strategies, i.e. those beyond the official national statistics office. In short, it hopes to capture the spirit of the "data revolution", a term used to capture the increasing importance and complexity of the role of data as well as innovations in the way the data is generated, processed and leveraged [9].

2   Research Methodology

The main research strategy chosen for this research was a desktop-based research approach using publicly available information sources including official reports, policies, media news reports and blogs, strategy documents, declarations, white papers, academic research, and annual reports. This was supplemented with an interview with executives from Statistics SA.

The desktop research employed a 'top-down' approach which involved the identification of more than 100 major actors in the international and South African data ecosystem as well as the search and analysis of more than 400 core documents. The guiding search criteria for the documents were the data requirements and sources as linked to the various SDGs, although recent documents addressing the Millennium Development Goals (MDGs; since they were the predecessors for the SDGs) data requirements, and those looking forward to the opportunities afforded by the Data Revolution in general, were also admitted. Documents were authored by both South African and international organisations (or individuals) from all relevant sectors of society. The final selection of documents used a heuristic combination of criteria including topic relevance, recency, representativeness, authority (of author), diversity (of view and author), criticality and comprehensiveness.

In order to avoid undue bias and to mitigate against gaps, a validatory 'bottom-up' parallel process was followed whereby two assistant researchers were tasked with identifying core documents for each of the individual SDGs and targets. Their findings were then checked against the initial analysis and, where gaps or inconsistencies were identified, these would be added.

A critical documentary analysis was then condensed into two main narratives:

1   The dynamics in the South African data ecosystem, with a detailed focus on the opportunities afforded by the data revolution and new information technologies.
2   A gap analysis of available data against the data requirements, in particular for the first five SDGs.

An interview with executives from Statistics SA allowed for a further validation of the findings as well as some further insights into the dynamics of the African data ecosystem and how Statistics SA is engaging with the Data Revolution.

3   Innovation and the Data Revolution in South Africa

Unsurprisingly, the confluence of information, mobile and data technologies is driving innovation in South Africa, as in many other African countries. In fact, the Information Technology and Innovation Foundation ranked South Africa 30th out of 56 countries globally in how its policies contribute towards innovation; this is more than 10 rankings ahead of any other African or BRICS country [10]. Many initiatives, prototypes and "proof-of-concepts" are being launched, sometimes originating from research organisations, innovation hubs, technology centres, incubators, or even larger operators, but at other times from independent innovators. Innovation in SA is supported by the availability of local talent, a good infrastructure, availability of capital, a diverse but unique domestic market context, and a supportive business and NPO sector, as well as by local government. Much of the innovation action is centred in the larger metropolitan areas, notably Johannesburg and Cape Town, although some smaller regional nodes (e.g. Stellenbosch) are also vying for some share of the action.

For example, Cape Town, using its attractive living environment and infrastructure as a drawing card for innovators, provides superb support for innovation through the Silicon Cape and Cape Innovation and Technology Initiatives (CITI). The region has a significant number of technology-focussed incubation spaces (Innotech, Tech Lab Africa/Rise Africa, Springlab, 88mph, Startup90, Impact Amplifier, LaunchLab), venture capital providers and a number of innovation accelerators supporting the fast growth of proven innovations.

Not surprisingly, some of this innovation focusses on the data revolution, and the potential of harnessing this data revolution for the SDG progress measures has been touted widely [11,12]. For instance, OpeniX (part of the Innovation Hub) tries to develop novel solutions to African problems using, inter alia, Earth Observation Data. Cape Town-based AfricanIdeas does research and disruptive innovation especially related to the impact of digitisation across society e.g. open/big data and smart cities. Code4Africa, has a very active South African chapter (Code4SA) based in Cape Town (Codebridge) and uses "data and technology to promote informed decision-making for social good". (This is not to be confused with the Code for Cape Town (Code4CT) initiative, sponsored by Innovate South Africa, which promotes technical development skills, primarily among school-age, female learners.)

Innovative data revolution approaches are enabled by a number of emerging technological vectors, including mobile technologies, cloud computing and many others. Given the space limitations inherent in a paper, this report will briefly consider only four nascent aspects which are frequently touted as potential game changers: open data, crowdsourcing, big data and the Internet of Things (IoT).

4   Open Data

South Africa's Open Data scene is still very young and fluid [13,14]. The national government's open data portal (data.gov.za) has only recently gone live although it has 409 Open Government Data (OGD) datasets – much of which are from Stats SA. The South African government's Open Data Partnership (ODP) commitment has barely touched the various MDAs, most of which are still struggling, trying to increase the scope and quality of (their administrative information systems. The situation is reminiscent of the national government's in-principle commitment to the adoption and promotion of open source software more than a decade ago, where this resolve failed to produce any significant impact, barring a very few exceptions. It is hoped that capacity building, particularly with respect to the development of better administrative systems, coupled with the education of the relevant decision makers, and investigations into the potential social contribution of open data, will improve the situation [15]. As an example, from the higher education annual detailed survey (HEMIS), two open datasets are published [13]. The first of these is the Department of Higher Education & Training (DHET)'s own open dataset, which is available on its website as eight anonymized data tables (on enrolments, graduates and staff) in Microsoft Excel format. The second open dataset is supplied by the Council of Higher Education (CHE) which publishes 18 data tables (each related to a specific performance indicator). An interesting use case of the CHE's Africa data set is the "empirical overview of eight flagship universities in Africa 2001-2011" which has made the data accessible to a large audience through a series of informative and visually attractive infographics, supported by detailed analysis. However, most central government data is currently not specifically licensed as open data, including most of the datasets provided by Stats SA. New legislation relating to the activities of Stats SA and SA's National Statistics System (NSS) will be proposed, probably in 2017, and may clarify the legal position on the use of official statistics.

A very few enlightened local governments have perhaps led the way by committing to the OGP. Notable is the City of Cape Town, which is leading the way for the local governments with its Open Data Portal[8] hosting at least 114 different detailed datasets. EThekwini, with an active Open Data community, is in the process of formulating an Open Data policy. Both cities have recently started with active and dynamic Open Data user groups under the auspices of Code4Africa. These groups are often aligned with both media (data journalists) and leading research universities (who are also moving towards open scholarship).

Sample initiatives from Code4SA based on Open Data include the Informal Settlements Matrix, Wazimap (allows maps to be overlaid with data points), the Parliamentary Monitoring Group (democratizing the information around parliamentary workings), Protest Map (graphical exploration of protests and their causes), or Newsmakers (visualizes who makes or has a voice in the media).

However, despite the surge of interest, commitment of a number of actors, and promising showcase innovations, there are some significant obstacles to be overcome.

- Many more datasets are needed, along with their metadata including detailed data definitions, provenance and usage information, and comprehensive data quality indicators. Datasets should come from different national and local governments, but ideally also anonymized datasets from the private and non-government organisation (NGO) sector. Health, socio-economic and education data are obvious first candidates. Where data quality is low, this should be explicitly annotated; however, the process of opening up data in itself can provide vital quality control and improved feedback loops.
- Detailed official geographic data should be available, including marked up map data from NGI but also Low Earth Orbit (LEO) photographs [16,17].
- More micro-data is needed, at the very least, to municipal or even lower levels of geographic detail, but also disaggregated along other dimensions (age, gender, disability and socio-economic dimensions)
- Unambiguous creative commons licensing of open (and all government-supplied) data. Much government data has unclear licensing.
- A culture of data consumption and innovation should be nurtured and promoted: despite the efforts of fervent and active advocacy groups such as Code4SA, much of SA society is not yet data-oriented. Sadly this lack of data-orientation includes many government and private sector employees responsible for data entry (resulting in low quality data) but, even more so, decision makers (resulting in many datasets of public utility and funded by public funds, e.g. DoH and MRC data, being unavailable).
- A relative paucity of infomediaries: there are still insufficient data integrators and intermediaries using, re-purposing, harmonising and meshing public data. Sample infomediaries are CrimeStatsSA which created a drill-down map interface to the SA Police Service (SAPS) provided crime-statistics, and DataFirst which

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[8] https://web1.capetown.gov.za/web1/OpenDataPortal/

harmonised labour market data from Stats SA's household surveys in their Post-Apartheid Labour market Series (PALMS).

5   Crowdsourcing

Crowdsourcing, not a technology per se but supported by a variety of technology platforms, is seen as one way of building or validating data [18]. The potential of using crowdsourcing by building open datasets is exemplified by OpenSeventeen.org which provides an Open Data crowdsourcing platform for the SGDs, including challenges, inspiration, and the opportunity to propose projects.

South Africa has already demonstrated the possibilities of crowdsourcing data. In fact, even before the term crowdsourcing existed, the very successful SA National Botanical Institute (SANBI)-sponsored Protea Atlas Project enlisted the help of the public in mapping the various Protea (a fynbos plant genus) distributions throughout southern Africa from 1991-2001. The dataset resulted in a quarter-million data records gathered by more than one thousand participants, and formed the basis for a large amount of new scientific data, including newly discovered species, a few new extinctions, and many revisions of habitat distribution[9]. This early project is notable, not only because it was a huge success despite it pre-dating the existence of mobile technology (with its geographic positioning, instant messaging, data and processing capabilities) but also because it addresses SDG goal 15 around the terrestrial ecosystems. It is unlikely that sufficient African data for some of the indicators for SDG goals 14 and 15 will be collected by traditional statistical means. A technologically updated platform for crowdsourcing eco-system data is the iSpot initiative, which is currently supported by SANBI[10], although it is too early to assess its success.

A more recent success story, addressing SDG goal 16 (justice, crime, corruption), revolves around South Africa's CrimeLine[11], an online or SMS-based hotline for reporting actual or suspected crime (resulting in more than fifty arrests in the first three months of 2015). Closely aligned is Corruption Watch[12], receiving over 200 reports monthly, with half of those conforming to their definition of 'corruption'.

Other indicators for assessing crowdsourcing in South Africa are the various global Wiki-like open data projects. South Africa's complexities are presented in the very mixed, if not paradoxical picture of Wikipedia contributions. The Afrikaans (language) Wikipedia has more than 41000 articles written by 158 active editors, with only about 7 million first language speakers. By contrast, the isiZulu and isiXhosa Wikipedias have less than 800 articles (many of which were contributed by diaspora members), despite having 12 and 8 million language speakers respectively. The situation is even worse for isiNdebele, Sepedi or Setswana that have no pages. This situation attests not only to cultural but also socio-economic, psychological, educational, and infrastructural (e.g. ICT access) inequalities[13].

A typical example of what could potentially be achieved is the global OpenStreetMap project, which was also supported in South Africa[14], although with very mixed success i.e. uneven coverage: Cape Town was mapped quite thoroughly but most other (especially rural) localities hardly at all. Crowdsourcing is definitely an option to be explored, but this will require investments in education and media exposure. Mobile-friendliness will be a key success factor, and issues of management, and quality management will need to be addressed.

6   Big Data

The potential of big data as a vector for discovering patterns between datasets and building proxies based on correlations of known data has been discussed widely [19,20,21]. A strong supporting factor in the South African context for big data is the huge penetration of mobile phones and the popularity of social network systems. Data sources on migration, traffic, location, households, social issues, etc. could quite possibly be mined and, with appropriate statistical normalisation and sampling methods, be used to extract new data or to update existing data.

However, big data still needs datasets, specialized skills sets and convincing SDG success stories. Datasets exist in social media, web analytics and mobile data, but these are currently not made available by the private sector data owners. Skilled analysts in the field of big data are slowly being trained but, currently, even the large corporates with the right (in-house) data and financial and human resources (e.g. South African retailers,

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[9] https://www.proteaatlas.org.za

[10] http://www.ispotnature.org/communities/southern-africa

[11] https://www.crimeline.co.za

[12] https://www.corruptionwatch.org.za

[13] https://www.htxt.co.za/2016/01/15/wikimedia-calls-on-more-south-africans-to-write-wikipedia-articles/

[14] http://wiki.openstreetmap.org/wiki/WikiProject_South_Africa

telecommunications companies, and retail banks) struggle to launch their internal big data projects or derive valuable business insights from them. As long as the status quo holds, big data will remain a promising technology.

One sample application of big data, aligned to the liveable cities goal, is in the potential alleviation of the long commute times experienced in many of the large African cities and almost all South African metropolitan areas due to traffic congestion. Combining mobile data with municipal traffic information systems and real-time big data processing may hold the key to innovative solutions. IBM is working with a number of municipalities and mobile innovators (WhereIsMyTansport, GoMetro, Ma3Route) in South Africa and Kenya to make traffic run smoother and to help commuters reach their destinations faster[15].

For big data to make a difference in the context of the SDGs, pilot projects should be initiated with major players in a selected industry. Candidates would include the largest mobile telecoms operators (MTN or Vodacom) and a strong but innovation-driven research partner (e.g. IBM or another big data industry player, possibly in collaboration with a funded academic partner). As with open data, a big problem is the lack of big datasets. Unfortunately, no South African telecoms operator to date has done so although a limited number of data explorations have taken place in research settings. By contrast, Orange – a mobile telecoms operator with a large footprint in francophone Africa but no presence in South Africa – has famously made some Ivory Coast and Senegalese anonymized mobile datasets publicly available for research and innovation under its "Data for Development"[16] challenge. Legislation will also play a potential limiting role in harnessing the promise of Big Data: South Africa's newly enacted Protection of Personal Information Act puts very tight constraints on what personal information can be collected, for what purposes, how it must be stored and kept safe, and how it can be shared [23].

7   The Internet of Things (IoT)

Another set of technologies underlying the unfolding data revolution is the Internet of Things (IoT): the exponential increase in number of devices connected to, and communicating via the internet, without human intervention. Globally, up to 100 billion devices are expected to connect to the internet in the next five years and, on the African continent, South Africa is touted to become one of the leading implementers. Although most IoT applications are primarily motivated by industrial or commercial use, the technology can also be harnessed for data gathering for socio-economic and environmental development purpose. Already huge numbers of devices generate data relating to population mobility and traffic (mobile phones; vehicle tracking devices, road toll tags); health (smart watches, fitness trackers and other wearable technologies); security (access cards; CCTV cameras); consumption patterns (credit cards, ATM transactions); energy and water (sensors, smart meters); agricultural, industrial and retail goods movement and distribution (RFID tags) and the like. A full IoT ecosystem will likely combine smart devices and massive numbers of less intelligent sensors, connected to mainly wireless networks and processed through cloud computing platforms.

Researchers in South Africa are exploring and piloting other potential applications such as the self-configuring wireless fire detector designed for dense informal settlements; water-quality sensors installed at various points throughout the water distribution network; weather and soil monitoring sensors in agricultural environments; safety and security devices and more. Currently, deployment encounters technical obstacles such as reliability, spectrum regulations, range, power, interoperability; economic issues such as sensor cost versus affordability and value, bandwidth cost, and cultural/societal issues such as user resistance, lack of trust, privacy and security concerns.

Thus, although IoT holds promise and potential as a means for data collection in the context of development goals, clear use cases and scalable, sustainable success stories need to be developed before a large scale commitment can be made [24]. As with big data, a sound scepticism is warranted. However, IoT's potential should not be ignored: just as mobile phone technology managed to achieve a large scale distribution of computing power and connectivity to much of Africa's population from an almost zero-base in less than a decade, IoT-technology could also leap-frog Africa's current lack of data to a comprehensive coverage of up-to-date data points. Immediate areas of potential are health (wearable devices); environmental monitoring (sensors); economic development; transport; food, water and energy supply and distribution; security and safety.

8   Gap Analysis

This section takes a brief look at the gap between available data and requirements in terms of the SDGs indicator requirements. Given the limited amount of space, the focus is on the four of the first five SDGs, given that they

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[15] https://www.smartercitieschallenge.org/cities
[16] http://www.d4d.orange.com

are prioritized also in Agenda 2063 and the NDP. Recurrent themes are the lack of disaggregated or micro-data, implying the lack of data in reference to marginalised groups and communities, especially "hard-to-reach" rural, disabled or migrant people, as well as masking local inequalities.

Poverty. Most poverty data is sourced from Stats SA through its census and household surveys, as well as additional inputs from relevant national government departments. Stats SA is to be applauded for taking a multi-dimensional and nationally relevant approach to poverty measurement. However, some of its data and reports are challenged by researchers [25] and civil society agencies (e.g. AIDC[17]). The insufficient disaggregation level makes it hard to assess the situation with reference to marginalised groups in society. Additional detail and insights have been provided by provincial government, NGOs and some university-based research units but, given that they are often survey, sample or case-based, these studies are not systematic.

Food. Statistics on hunger, food security and nutrition are generated based on census with inter-decennial interpolation done on the basis of the (now rolling) household surveys using stratified sampling/proportionality corrections. Where demographics change rapidly (e.g. through changing migration or mortality patterns), distortions and biases will occur. Additionally, short-term environmental changes such as droughts (having huge agricultural impacts), employment and price shocks (frequent, given the volatility of the Rand) have disproportionally large impacts on the food security and choices of the poor. Disaggregation at the local level and by vulnerable groups (the young and elderly, females, disabled) is still sketchy.

Health. Although there is selective and representative data for many of the health indicators, much of it is based on surveys, given the lack of a proper National Health Information System (NHIS). Much data is produced by non-government agencies, including international foundations and many non-profit organisations dedicated to specific areas e.g. the Cancer Association of SA[18] (CANSA) and the SA National AIDS Council[19]. Major concerns related to poor quality data, inconsistencies (between the many different players), and siloed or unavailable data. Sadly, the latest South African Department of Health (DoH) dataset is one of only a few African DoH which is not available online.

 Another big issue is the long cycle which does not pick up trend changes. For instances, even though HIV infections have stabilised, if not declined, potentially different infection patterns are emerging (rural versus city; or intergenerational sex). Moreover, diseases such as malaria and tuberculosis are very regional and prone to dramatic short-term dynamics, and hence require much shorter diagnosis-intervention cycles. Given that an adequate NHIS is unlikely to be established in the near future, apart from the continued involvement of many non-government agencies, this is where technical vectors from the Data Revolution could deliver real value, including crowdsourcing, big data and IoTs such as wearable technology.

Gender Equality. Although all official surveys include a question on gender, this wealth of data on women is often not exploited to examine gender inequalities; and more specific gender inequality indicators are often not measured. Stats SA has now singled gender statistics out as a special initiative to be supported by an annual survey, but there are currently still major gaps on many of the required SDG indicators. A number of organisations work around specific themes, but their work generates only sample-based data, often without a clear view on generalisability. Some themes have no or completely unreliable data; for instance, the indicators around harmful practices (5.3) including female genital mutilation and early or forced marriage (ukuthwala = abduction and forced marriage of girls) [26]. The incidences for rape and other sexual violence are a huge unknown, with the official statistics (as stated above) hugely under-estimating the real values; this is acknowledged by all, including Stats SA and SAPS. Statistics for women and care work are dated, although Stats SA aims to expand their gender statistical information base including, valuing of work done by women using the Time Use Survey. The following quote accurately sums up the situation: "*No quantitative or even qualitative data exists to help understand us and the extent to which social, economic and cultural factors influence our school enrolment, literacy and upward mobility of girl children in South Africa.*" [22] (p. 2)

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[17] http://aidc.org.za/response-to-the-star-newspaper-article-entitled-poverty-data-not-a-correct-portrayal/
[18] http://www.cansa.org.za/cancer-facts-research/
[19] http://sanac.org.za/category/publications/reports/

Gaps in Respect of the Other SDG Goals. Although the government claims that 94% of SA's population has access to clean water, this statistic has been attacked by the media[20]. Despite the efforts of both the Department of Water (Blue Drop status reports[21]) and the Water Research Commission (WRC)[22], triangulation of quality data is necessary, both through capacity-building at local government level as well as potentially through scalable and sustainable crowdsourcing and Internet-of-Things (IoT) initiatives.

Electricity use data is mainly available from Eskom, the state-owned entity responsible for its generation [27]. However, it is only disaggregated to user type (residential/industrial) and regional level (municipality) since many municipalities perform the distributor role (and use electricity as an income generation activity). Little or no data exists on the trends in, and sustainability of, using firewood for heating, both in rural and in informal city settlements.

Given the huge political and social importance of unemployment, Stats SA has invested significant resources in publishing regular and time-consistent unemployment figures, and the quality of the methodology and consistency of the generated statistics is very high at international standards. However, the political nature of and general methodological issues associated with unemployment data mean that these statistics remain the subject of much substantive criticism, with suggested unemployment rates ranging from less than 27% (Stats SA, which only counts those who take active steps to look for work or become self-employed) [28] to 36% (Solidarity Research Institute[23]) or more. It is unclear how to resolve issues of definition of (un-)employment and internationally comparable statistics at the country-level.

Some crimes (including rape and domestic abuse) and much of corruption are hugely under-reported in the official statistics, as stated above. This situation is unlikely to improve substantially in the near term, so proxies will need to be developed through engagement with dedicated researchers and NGOs, possibly involving anonymous crowdsourcing platforms and stratified surveys.

Human trafficking is a huge problem but its real incidence is unknown. The South African government takes the issue very seriously but, given the nature of the problem, collaboration with NGOs and citizens is necessary in getting a better estimate of the incidence rates, gender/age patterns and time/regional trends.

Reliable and comprehensive environmental and the natural eco-system indicators are currently also not addressed: "Currently, however, monitoring systems for water flows and quality, air quality, deforestation, and other land degradation are inadequate" [29]. Given the NDP priorities, these are also unlikely to receive many resources from within the NSS in the near future, so engagement with other actors and innovative alternatives are needed. Innovation possibilities including IoT-based sensors, crowdsourcing and automated analysis of LEO-imagery. As these approaches are being developed over time, it is likely that some reliable base figures may not be obtained in the short-term future.

Many other indicators relating to socio-economic inequality, road and traffic accident data, migration, human settlements, sustainability initiatives and reporting are also not available and will require innovations in methodology, the improvement and opening up of existing micro-data stores and the engagement of non-traditional data collection actors.

9   Conclusion and Recommendations

The above discussion illustrates that South Africa's NSS still falls short of being able to provide accurate data for all indicators. Even for many indicators where it can provide data, the necessary disaggregated data to ensure "that no one is left behind" may not be necessarily be available in all disaggregation dimensions. Bearing in mind that not all SDGs carry equal import to South Africa and that limited resources must be prioritized, we make the following recommendations, focussing on quick gains and the low hanging fruit.

Even though Stats SA has already completed an exercise to map the SDG indicators onto the NDP, it is critically important that it makes and communicates a clear decision of exactly which SDG indicators and to what level of disaggregation Stats SA and other organs of the NSS will commit to collecting and providing annual data for. Where these data requirements necessitate additional resources beyond its current mandate and capacity, a resourcing plan should be tabled to national government (if it falls within the national priorities) and supra-national agencies. Crucially, the latter should also acknowledge the current and future role which Stats SA can play in building regional NSS capabilities in respect of the SDG indicator requirements, and a formal regional statistical development and assistance programme could be formulated and funded.

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[20]   https://africacheck.org/reports/claim-that-94-of-south-aclaim-that-94-in-sa-have-access-to-safe-drinking-water-doesnt-hold-water/

[21] http://www.dwa.gov.za/Documents/RSP.aspx

[22] http://www.wrc.org.za/Pages/KnowledgeHub.aspx

[23] https://solidariteit.co.za/en/harmful-policies-worsen-unemployment-solidariteit/

A commitment by the NSS to provide identified SDG indicators (to an explicit level of detail) will, by implication, open up the remaining SDG indicators (or additional required detail under "provided-for" SDG) as needing action by other actors, in accordance to national, African, and international priorities. Given that the National Government has underwritten the SDGs, its executive needs to develop a clear and detailed action plan detailing which SDG targets and associated indicators will be covered by the NSS, and how the remaining targets will be dealt with by entrusting the responsibility to MDAs or, by means of appropriate incentives, private sector organisations. The SDG data agenda will need to be formalized, and coordinated, at least at national, but ideally also at international, levels. The agenda can thus be opened up to researchers and research organisations, private-public partnerships, NGOs and the public at large. Ideally, or perhaps even necessarily, there should be specific financial incentivization relating to each of the indicators (arguably mainly from UN & international aid, in line with some of the commitments under SDG Goal 17), possibly through an open bidding or crowdsourcing initiative. Although this approach will entail comparability, delivery, quality and management issues, it will build local capacity and strengthen local research and innovation skills among citizens and institutions. In particular, the strong capabilities of South Africa's research councils and universities should be engaged actively in this agenda; this can be achieved practically through dedicated research funding instruments with research funds allocated from national and supra-national government.

The role and importance of Open Data in this context cannot be overstated. OGP buy-in, commitment and roll-out at national and local government levels must be hugely accelerated. A crucial obstacle here is to change the mind set of government decision-makers to realize the importance and potential benefits of releasing their departments' anonymized micro-data along with meta-data and data quality indicators. Not only Stats SA, but other government departments should aggressively pursue useful Open Government Datasets (under an explicit, non-restrictive license). In this particular case, sorely needed open data relating to SDG indicators includes not only open GIS data and Stats SA micro-records, but also disaggregated educational, health and social services data from internal administrative systems. The latter will require strengthening the education and health information systems, entailing many required system technical and business process improvements but also educating users into a data mind set. For social justice and achieving underlying SDG outcomes, opening up other datasets such as public tender information (although this is being worked on), service delivery, and similar microdata is equally important.

The promise of a big data approach must be assessed critically: many tools are immature, skill sets are scarce, use cases even rarer but industry hype remains high. The only way to assess big data potential for SDG data is by means of real world projects. Selected private sector organisations need to be convinced to release certain datasets which can be shown to have a social value: data philanthropy needs to become a recognized and actively practiced form of corporate social responsibility. More specifically, representative commercial datasets from the two major telecoms operators and major internet players (SNS, search engine) should be released to allow researcher and community-based innovators to experiment with big data or even data mining solutions to provide answers to SDG-related research questions. Ideally this happens in a collaborative fashion, enabling the companies themselves to benefit from the innovations and insights (as Orange has done in its D4D i.e. Data-for-Development challenge using Ivory Coast and Senegalese data sets). Given that both of South Africa's market-dominating telecom operators have a much wider African footprint, and the major SNS and search companies operate globally across many developing countries, a wider social responsibility case can be made; but, if necessary, more national pressure can be exerted. Additionally, experiments with other large datasets such as those extracted from retail or financial records can be used. Coupled to the datasets must be the identification of existing and further development of the relevant skill sets inside the country, ideally through the incentivization by means of competition coupled to focussed funding or sponsorship by research funding agencies and industry players. Data philanthropy is generally considered to embrace not just the selective and controlled opening up of corporate data sets, but also the sharing of the skills, expertise and tools by these organisations to analyse these big data sets.

Linked to this argument, an argument can be made for targeted investment in and formal support for data revolution innovation in both the private sector as well as in the more formal research community. Many of these are likely to require not only technical and social innovations, but the projects themselves might need to be managed under novel collaborative arrangements, merging citizen engagement, for-profit companies and researchers. Some obvious targets that can benefit from data-based innovations are:

- Public and private transport systems: given that South Africa's biggest metropolitan areas are experiencing huge increases in traffic congestion, linking mobile call detail records onto traffic arteries is long overdue, possibly incorporating other aspects (e.g. using the accelerator to look at driving style)
- Crime prevention and reporting: given the particularly high levels of crime in South Africa, it is ripe for device-driven innovations, including IoT interventions, tracking devices, ad hoc mobile 'emergency' networks, perhaps even experimenting with moving from CCTV to "Open"-Circuit TV.

- Natural environment: developing sufficient data points to produce some of the indicators relating to the national environment will require a combination of technologies (mobile, IoT, drones, LEO data) with crowdsourcing and machine-based pattern recognition.

The role of the media in evidence-driven SDGs needs to be encouraged; a further and increasing investment in data-driven journalism as well as training more data-savvy reporters will contribute to developing a better informed citizenship, as well as influence the mind sets of decision makers and key stakeholders.

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Impact of teacher demographic factors on perceptions of ICT-enhanced teaching and learning in inclusive schools: Johannesburg Central District, South Africa

✉Charlotte Lungile Hlengwa[1], Bester Chimbo[2] and Sheryl Buckley[3]

[1] University of South Africa, Pretoria, South Africa
hlengcl@unisa.ac.za
[2] University of South Africa, Pretoria, South Africa
chimbb@unisa.ac.za
[3] University of South Africa, Pretoria, South Africa
sherbuck@gmail.com

Abstract. Inclusive schools cater for a diverse learner population, which includes learners with Special Needs and those who have learning barriers. Inclusive Education, as an ongoing and progressive education system, demands dynamic learning environments that will promote access to education for all. Teachers are active agents and part of the enablers in implementing inclusive education (IE) system. ICT-enhanced teaching and learning facilitates inclusive pedagogical practice that promote thriving inclusive schools. Giving focus to teacher perceptions of ICT is critical in the pursuit of ICT-enhanced teaching and learning in inclusive schools. Demographic factors do have an impact on perceptions and attitudes. This study explores the influence of teacher demographic factors on their perceptions of ICT use in inclusive schools. A quantitative survey was conducted by administering questionnaires to 78 teachers and 4 principals in the four inclusive schools within Johannesburg Central District. The results of the study indicated that teachers have a very positive stance on using ICT in teaching and learning in inclusive schools. Demographic factors such as age, gender and teaching experience do not influence their perceptions of using ICT in inclusive schools, expect professional qualification which has an influence on teacher perceptions of their ICT competence. This is very useful as teachers of all ages, gender, experience and qualification have similar positive views on ICT use in Inclusive Schools. Teacher ICT perception is not a barrier in the pursuit of ICT-enhanced teaching and learning in inclusive schools.

Keywords: demographics, ICT-enhanced teaching and learning, inclusive schools, inclusive education, South Africa teacher perceptions.

1   Introduction

Our world is changing and developing. Central to this change are Information and Communication Technologies (ICT). In education, a key issue has been promoting an inclusive Education For All [1, 29]. From studies that synthesize the role of ICT in education and development, it was found that various collaborative international development initiatives, including the field of education have focused on ICT to provide innovative responses to developmental challenges experienced [15]. Since the dawn of the new democracy of the Republic of South Africa, transforming learning and teaching through ICTs has been a vision from the South African National Department of Education (DoE). This vision culminated in Whitepaper 6: e-Education [29]. The Department of Education (DoE) made enormous investments by providing computers and established relevant policies, so as to provide an environment where learners with varying abilities; and the community could access varied technological services for educational, personal and community development [19]. Parallel to these ICT related educational developments was the move towards an Inclusive provision of education where all types of learners can learn in the same settings. Inclusive education and e-education are adopted education systems in South Africa and should therefore be complementary to each other.

E-Education speaks to the provision of education using technology. A key tenet is that perceptions of ICT are vital to harness any innovative ICT solutions in solving problems. However, in education teachers play a key role in providing education; therefore teacher perceptions of ICT can drive any innovative ICT solutions for enhanced teaching and learning. Teacher attitude and perceptions have been investigated in mainstream education research; however, there is a paucity of research in inclusive education (IE). There is limited research in the area of ICT and inclusive schools. As a developing country, implementation of any sort needs to go through a lens of investigation as to "quickly" assess impact, effectiveness and deal with identified barriers. All the efforts are needed to improve any implementation. A lot of effort has been introduced to make this system a success. One of

the barriers to any ICT strategy for implementation is perceptions and attitudes. As teachers play a key role in the education system, focus should be on the inclusive schools' teachers' perceptions of ICT in their schools. Theory of planned behavior [30] informs that attitude and perception have an impact on the ultimate commitment of a behavior (follow-through). There are determinants to perceptions and attitude- demographics of age, gender and level of education [34]. This paper therefore will enlighten on the role of teacher demographics in ICT perceptions within inclusive schools in Johannesburg Central District, South Africa. Teacher demographics have an impact on teacher perceptions of ICT enhanced teaching and learning in inclusive schools. Various stakeholders will be able to address these barriers which will shape any strategy for further ICT implementation in inclusive schools. Removing barriers is very necessary in this slowly developing education system.

The paper is structured into the next section, background information and the various aspects of inclusive schools. Also the paper is structured in this matter to understand the context to which this study is set. Thereafter, we outline a brief discussion of ICT-enhanced teaching and learning.

1.1 Inclusive schools and inclusive education

In this section inclusion in the context of education and the ideas around ICT-enhanced teaching and learning will be discussed. Firstly the background to inclusion will be layed out before elaborating on inclusion in the education context.

In 1994, representatives of 92 governments and 25 international organisations met in Spain to deliberate on the issues of inclusive education [24]. An outcome of this meeting was the issuing of a policy statement called the Salamanca Statement. Out of this statement came the usage of the terms "inclusion" and "inclusive education" in the domain of government. The view was that countries should focus their efforts on developing inclusive schools that cater for all types of learners and that this approach is rights-based ("The Salamanca Statement and Framework for action on Special Needs Education,"[24]. It is therefore essential to establish mechanisms that promote, facilitate and 'secure' an IE. It is crucial that the concept of inclusive practice in school environments be established. ICT-enhanced teaching and learning is one of the greatest mechanisms that can create conducive inclusive environments.

Understanding what inclusive education is will enable inclusive schools to shape their educational provision so that all types of learners can benefit. The Enabling Education Network, a key voice in the education arena, suggest what elements for inclusive education are:

- a persistently progressive process of change and improvement
- reorganisation of education cultures, policies and practices
- changing the thinking within the education system
- identification and removal of identified barriers
- solving attitude, practice, policy, environmental and resource barriers
- process in which all stakeholders should participate and
- can happen outside the formal education system [11]

Identifying, removing and solving barriers for example changing attitudes and perceptions, affords inclusive schools the opportunity to implement an effective and successful ICT-enhanced teaching and learning because technology will likely be used according to the Theory of planned behavior (TPB) [30].

1.2 ICT-enhanced teaching and learning

E-education is about the utilising ICTs in education (teaching and learning). The Department of Education (DoE) in South Africa, has geared itself to promote e-education which, through effective combinations of technology and pedagogy, will connect teacher and learners to better information, ideas and to one another [19]. Successful integration of ICTs into teaching and learning is one of the pillars of e-education. This pillar heightens meaningful interaction of learners with information and also provides meaningful advancement of cognitive abilities [19]. Computer-integrated learning provides another level in the equipping of all learners for full participation in the knowledge society before they leave for higher education and training institutions. Computer-integrated learning can be described as ICT-enhanced teaching and learning. Strategies need to be looked at on how to increase ICTs impact on access, cost effectiveness and the quality of education for all, and also the way they are integrated into the learning and teaching processes [19]. Inclusive schools have a prerogative to provide e-Education to their cohort of learners, all types of learners. There is a paucity of research focused on ICT and Inclusive education (IE) [15]. Even though there were extensive studies on ICT in education, inclusive schools are emerging as a new area where there is a need for such research. This study aims to add to that body of knowledge and advance the cause for better understanding of the role of ICT in inclusive schools. This preliminary research serves as a

platform to begin to address the questions posited by the United Nations Convention on the Rights of Persons with Disabilities on "how can better service be delivered, with what materials and in what setting" in inclusive schools [26]. Addressing these questions contributes to attaining equitable education for all types of learners in their preferred learning institutions.

This paper therefore interrogates the role of teacher demographic factors in influencing ICT perceptions for ICT acceptance and use in inclusive schools. ICT acceptance and use will have an impact on ICT-enhanced teaching and learning. In order to position the paper and provide support for the problem, the following section offers a review of literature on teacher perceptions and the influence of demographics on perceptions.

2 Literature review

2.1 Teachers' ICT Perceptions

There are many demands of the inclusive education system on teachers; and teachers' empowerment and competence is crucial to realise attainment goals. They must plan for and accommodate a diverse range of learning needs. ICT-rich learning environments not only empower student learning, but also allow teachers to monitor the progress of a student or a group of students, and then intervene quickly and effectively. Creating ICT rich learning environments in our classrooms and training educators to personalise a student's learning experience are key pillars to attaining a fully inclusive education model but the attitudes of teachers in particular in relation to using ICT are crucial. As teachers may not feel the need to change the traditional education system because it has been successful in the past [13], understanding their views and perceptions is vital in order to seek strategies for moving the inclusive schools towards ICT-enhanced teaching and learning for all types of learners.

McKenzie (2004) cited by [16] emphasises that enforcing technology on teachers without proper orientation may not result in positively engaging teaching environments. Orientation includes understanding their views and attitudes on the ICT itself so that engagement may be optimal. Teachers experienced varying outcomes, both positive and negative, after they were exposed to ICT assistance in the form of laptops [16], smartboards and mobile phones. Negative experiences may lead to these technologies becoming white elephants according to [9]. It is thus imperative to study the teachers' experience, attitude, and perception of ICT usage in classrooms. Albirini (2006) cited in [2] endorses the fact that use of new ICT technologies in the classroom is majorly predicated by teachers' attitude and perceptions.

Teachers' perceptions have been studied from different angles. Some teachers see ICTs as a potential tool to aid learning whereas others seem to disagree with the use of technology in early year settings [20]. Teaching at foundation phase may be different than teaching at senior phase where learners should have acquired the basic computer literacy skills and tend to be more independent in their thinking and reasoning. Foundation phase learning environments are very fundamental to learning core literacy and numeracy skills. These environments open doors to an exciting world around us and the learners' young minds need to be captivated, excited and trained. When utilising ICTs like computers, teachers would need to be very open-minded as to how best to captivate diverse young learners with a myriad of needs. Blatchford & Whitebread (2003:16) in [17] are of the opinion that ICT use in the foundation phase hampers learning and is unhealthy. However other foundation phase educators who support ICT utilisation within educational settings take a softer view than this and propose that ICT is acceptable because it has other stimulating experiences that young children will benefit from.

The teachers need to be confident in their knowledge of ICTs. New technologies could pose barriers to the teachers themselves if they are not well trained in them. [17] is of the view that when teachers have experienced ICT in their learning, they may have a positive attitude towards it; "and the opposite" may be true that a lack of ICT experience in teachers' learning may create a negative attitude towards ICTs. Another issue that may influence teacher perception could be the educator's personal characteristics of age and gender [7]; educational and teaching experience perhaps with teaching practice that is seen to be tried and tested. For teachers to start using technology within their curriculum, there needs to be a sense that their current pedagogy is not satisfying and that the change is comprehensible, plausible and useful in new situations [28]. In public schools, the teacher's view is usually on large groups of learners in small spaces; therefore, technology use must be seen as providing ease of use to that potentially stressful environment.

Teacher perception may have a significant contribution to Individual Readiness [22]. Individual Readiness encompasses characteristics, which include an individual's beliefs, attitudes, level of development, motivation, attitude towards learning and resistance to change (Chapnick, 2000) in Setati [22]. This assumes that perception can be swung positively or negatively due to other influences within or without the individual. Teachers play a vital role in ICT-enhanced teaching and learning. Teachers' perceptions of the role of ICT and it's benefit to teaching and learning influences their actual use of the technology [14, 21].

Meta-analysis of research on ICT in teaching and learning has been carried out over the years. Major categories in these researches are "attitudes, opinions, perception and assessment of teachers' assumptions" of ICT use in education; and the role of the internet as a teaching and learning tool [21]. This study attempts to fill in the gap on research of teachers' perceptions of ICT in inclusive schools within the Johannesburg Central District, with a special focus on the role of demographic factors in perceptions differentiation. In a review of literature on factors affecting teachers' use of ICT [32] concluded that there are three interlocking factors which are institution, resources and the teacher. The effects, impact and influence of demographic factors on perceptions and attitudes have been given much study. As the Department of Education strives to find innovative solutions on how to implement and enhance inclusive education, this rudimentary study contributes to the body of knowledge that informs on how teachers view ICTs that could be utilised in the provision of inclusive education for all. The next section sums up the research methods employed in this study.

3   Research Methodology

3.1   Theoretical Conceptual Framework

In this study, the Theory of planned behavior (TPB) was employed. According to [30], as it suggested that "intentions are assumed to capture the motivational factors that influence a behaviour; they are indications of how hard people are willing to try, or how much of an effort they are planning to exert, in order to perform the behaviour". TPB is constructed with attitudes, subjective norms and perceive behavioural control. The TPB attitude construct was altered and replaced with teacher perceptions to fit this study. Figure 1 represents the hypotheses for this study and the research model adapted from [33].
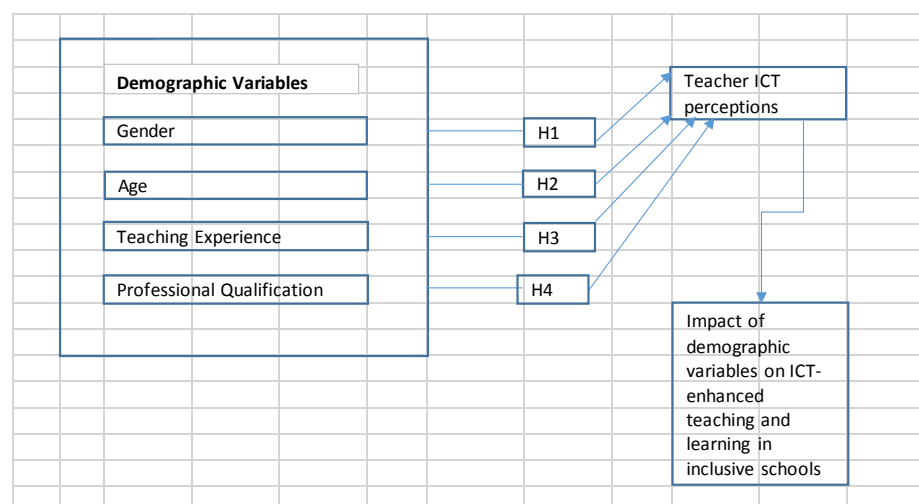
Figure 1 Research theoretical model

Hypotheses to be tested:

H1 = Gender has an influence on ICT-enhanced teaching and learning in inclusive

schools when mediated by teacher ICT perceptions

H2 = There is a significant relationship between age and ICT-enhanced teaching and

learning in inclusive schools when mediated by teacher ICT perceptions

H3 = Teaching experience has an impact on ICT-enhanced teaching and learning in

inclusive schools when mediated by perceptions

H4 = There is a significant relationship between teacher professional qualification

and ICT-enhanced teaching and learning in inclusive schools when mediated

by teacher ICT perceptions

3.2   Data Collection and Analysis Methods

In this study the survey method was employed to provide a quantitative or numeric description of ICT perceptions of the teacher population in inclusive schools by studying a sample of that population. The data was presented using descriptive and inferential statistics. In this case, the quantitative research enabled the researcher to explore the influence of teachers' demographic factors on their ICT perceptions. From these results the researcher generalised or drew inferences to the population [8].

Seventy-eight educators participated in the study out of a total of 127 educators giving a response rate of 61%. This response rate was much higher than the average response rate 55.6% with a standard deviation of 19.7 as reported by Baruch (1999) in [15] a meta-analysis of 176 academic journals. Thus, the response rate is deemed acceptable. The terms "educators" and "teachers" were used interchangeably. School Management Team (SMT) members of the School Governing Body (SGB) were also included in the study because some have teaching time in class and or were computer specialists.

4   Data Analysis

4.1   Introduction

Data was entered in Microsoft Excel and then exported to Statistical Package for the Social Sciences (SPSS) version 2.4 for analysis.

4.2   The Characteristics of the Sample

The characteristics of the sample are shown in Table 4.1.

Table 4.1 Characteristics of the sample

Variable	Category	Frequency	%
Gender	Female	70	89.7%
	Male	8	10.3%
	Total	123	100.0%
Teaching experience	1 - 5 years	15	20.0%
	6 - 10 years	11	14.7%
	11 - 20 years	26	34.7%
	More than 25 years	23	30.7%
	Total	73	100.0%
Professional qualification	3 year diploma + teacher experience	41	53.9%
	Bachelor's degree	6	7.9%
	Bachelor's degree + teacher experience	28	36.8%
	Master's degree	1	1.3%
	Total	76	100.0%

4.3 Validity

The validity of the constructs is shown below in Table 4.2.

Table 4.2 Validity

Factors and observed variables	Loadings	Eigenvalues	% of variance
Factor 1: Curriculum enhancement		3.645	19.19%
Q7n. Using ICT can assist with flexible assessment for learners with barriers.	.922		
Q7m. I need ICT to make the curriculum suitable for learners with barriers.	.921		
Q7l. ICT can give me flexibility to transform the curriculum to suite learners with barriers.	.891		
Q7k. If some students with learning barriers learn better with computers, that would encourage me to use computers to enhance the curriculum.	.802		
Factor 2: Teaching using ICT		3.486	18.35%
Q7h. Computers will only put more work on the shoulders of the teachers (*R).	.930		
Q7g. Capable teachers do not need ICT to teach efficiently (*R).	.906		
Q7i. Using ICT can prevent me from being creative in teaching (*R).	.897		
Q7f. Learning to use ICT in teaching is a waste of time (*R).	.599		
Factor 3: Teacher competence		2.603	13.70%
Q7b. It is very important for me to learn how to use ICTs	.896		
Q7c. Learning to operate ICTs is like learning any new skill -the more you practice, the better you become.	.852		
Q7a. Knowing how to use ICT is a worthwhile skill.	.844		
Factor 4: ICT in education- Teaching		2.058	10.83%
Q7q. Using ICT can make teachers more flexible in teaching.	.835		
Q7p. ICTs are necessary for quality education.	.741		
Q7d. Working with ICT makes me feel tense and uncomfortable (*R).	.606		
Factor 5: ICT in education – Priority		1.745	9.18/%
Q7t. When school budget is limited, upgrading ICT should not be an urgent priority (*R).	.682		
Q7r. Our school computers offer me knowledge and information that assists in teaching.	-.568		
Q7e. I am confident with my general ICT knowledge for example typing documents and using the Internet.	-.532		
Q7o. The curriculum is very complex therefore ICT cannot assist in making it simpler (*R).	.532		
Factor 6:		1.159	6.10%
Q7j. My teaching style can change when I integrate technology	.924		
Total variance explained			**77.35%**

The constructs in the questionnaire were derived from well-validated portions of several attitudinal survey questionnaire [36] that have been used with teachers in the past but now adapted for the specific use in this study.

4.4   Reliability

The instrument was first tested for internal consistency reliability using Cronbach alpha. A high value of Cronbach signifies that the items are measuring the underlying (or latent) construct. The Cronbach alpha ranges from 0 to 1 and a value of 1 denotes perfect internal reliability and 0 denotes no internal reliability [10]. [19] provided a rule of thumb where if Cronbach alpha is $\geq .9$ – excellent (high-stakes testing), $\geq .7$ – good (low-stakes testing), $\geq .6$ acceptable, $\geq .5$ poor and $< .5$ unacceptable. The reliability of the instrument is given in Table 4.3 below.

Table 4.3 Reliability results of the construct

Aspect	No. of items	Cronbach's alpha	Acceptable level
General ICT perceptions	20	.834	Good

4.5   Inferential statistics to determine the impact of teacher demographics on ICT-enhanced teaching and learning when mediated by teacher ICT perceptions

In terms of inferential statistics, the independent t-test and ANOVA were used to determine the impact of demographic characteristics on ICT perceptions. The independent t-test was used where the variables had two categories while the ANOVA was used where the variables had more than two categories. The independent t-test was used to determine whether the means were different by gender at the 5% level of significance. The composite variables were found by averaging the Likert scale items. The tests were done at the 5% level of significance using the p-value approach. A p-value less than .05 led to the rejection of the null hypothesis indicating mean differences and if the p-value was less than .01 then the test was highly significant. Both inferential statistics were done using the p-value approach. Assuming the null hypothesis is true, the probability that the test statistic will take on values as extreme or as more extreme than the observed test statistic (computed from the sample) is called the p-value of the test and the smaller the p-value computed from the sample data, the stronger the evidence against the null hypothesis [31]. The results of the test are significant if the p-value is less than .05.

Independent t-test to determine difference in mean score by gender The test for homogeneity of variances and equality of means resulted in all aspects having p-values greater than .05. The ratio of females to males is 9 is to 1. Thus, close to 90% (n=70) are females while 10.3% (n=8) were males. The gender composition is not representative of the South African workforce where 56.6% were males while 43.4% are females [23] but is in agreement with the feminisation of the teaching profession [25]. Gender did not have an impact on teachers' ICT perceptions and use in teaching and learning. Even though there was an uneven representation of gender, where male = 8 and female = 68, there were equal mean scores on the dimensions by gender and thus the perceptions were the same for both males and females. This gender disparity speaks to the feminisation of education.

ANOVA test to determine differences in means by age The age group was divided into four groups of $25-34$, $35-44$, $45-54$ and $55-64$. The test of equality of variance across groups had all p-values being more than .05. The largest proportion of respondents were aged 45 - 54 years with a proportion of 40.8% (n=31) followed by those aged $35-44$ years with a proportion of 28.9% (n=22). Thus, close to 70% of the respondents were aged between $35-54$ years. All dimensions had p-values more than .05 indicating that there was no difference in mean scores. Thus, there was no difference in teachers' ICT perceptions by age. Age was not a distinguishing factor in teacher's ICT perceptions.

ANOVA test to determine differences in means by years of teaching experience The years of teaching experience was divided into four groups which are $1-5$, $6-10$, $11-20$ and more than 21 years. The majority of the respondents had more than ten years' experience. The largest proportion, that is, 34.7% (n=26) had $11-20$ years' experience and 30.7% (n=23) more than 25 years. Only 34.7% (n=26) had at most ten years of experience. It can be concluded that teachers were very experienced. The test on equality of variance was not violated in all dimensions as demonstrated by all p-values being more than .05 indicating that there was equality of variances within groups. All dimensions had p-values more than .05 indicating that there was no difference in means, that

is, there was homogeneity of means. Therefore the mean scores do not differ due to years of teaching experience. Thus, teachers' ICT perceptions were the same regardless of the years of teaching experience.

ANOVA test to determine differences in means by professional qualification The professional qualification were categorised into three groups of three- year diploma + teacher experience, bachelor's degree and bachelor's degree + teacher experience. The test of homogeneity of variance had all p-values being more than .05 indicating that the variances were equal. The ANOVA results of the tests are shown in Table 4.4.

Table 4.4 Test of homogeneity (ANOVA) of professional qualification

|		Sum of squares	Df	Mean square	F	Sig.
Q7. Teacher competence	Between Groups	1.415	2	.708	3.223	.046
	Within Groups	15.371	70	.220		
	Total	**16.787**	**72**			
Q7. Teaching using ICT	Between Groups	.721	2	.360	1.079	.346
	Within Groups	23.042	69	.334		
	Total	**23.762**	**71**			
Q7. Curriculum enhancement	Between Groups	.433	2	.217	.921	.403
	Within Groups	16.462	70	.235		
	Total	**16.895**	**72**			
Q7. ICT in education	Between Groups	.324	2	.162	1.084	.344
	Within Groups	10.163	68	.149		
	Total	**10.487**	**70**			
Q7. General ICT perceptions	Between Groups	.565	2	.282	2.461	.093
	Within Groups	8.033	70	.115		
	Total	**8.598**	**72**			

A= Teacher competence; B= Teaching using ICT; C= Curriculum enhancement; D= ICT in education; E = General ICT perceptions

The test of equality of means resulted in all dimensions having p-values of more than .05 except the dimension "*teacher competence*" with a p-value of .046 which was less than .05 indicating that the means were different. The dimension resulted in an F-value of 3.223 with a p-value of .046 leading to the conclusion that there is difference in perceptions across professional qualifications. The effect size was .08 which is a small effect and the Tukey B post-hoc test showed that there were two homogeneous groups as shown in Table 4.5.

Table 4.5 Tukey B post hoc tests of teacher competence

Tukey B[a,b]			
		Subset for alpha = 0.05	
Q6. Professional qualification:	N	1	2
3 year diploma + teacher experience	40	3.1558	
Bachelor's degree + teacher experience	27	3.3333	3.3333
Bachelor's degree	6		3.6333

The major difference was between those with three-year diploma + teacher experience and Bachelor's degree. Those with three-year diploma + teacher experience had the lowest mean of 3.16 whilst those with Bachelor's degree had the highest mean of 3.63. This is also supported by the non-overlapping between the confidence interval error bars shown in Figure 4.1.
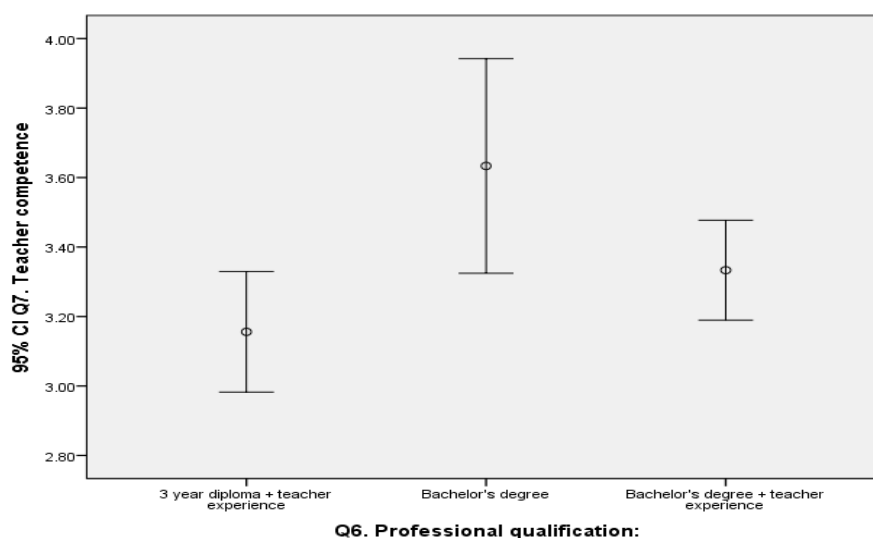
Figure 4.1 Confidence interval error bar for teacher competence by professional qualification

Those with three-year diploma + teacher experience had means close to three indicating that they were in agreement while those with bachelor's degree had means close to four indicating that they were agreeing strongly. Thus, those with bacherlor degrees agreed strongly on teacher competence issues.

The results have indicated that:

H1 = Gender has an influence on ICT-enhanced teaching and learning in inclusive schools when mediated by teacher ICT perceptions [REJECTED]

H2 = There is a significant relationship between age and ICT-enhanced teaching and learning in inclusive schools when mediated by teacher ICT perceptions [REJECTED]

H3 = Teaching experience has an impact on ICT-enhanced teaching and learning in inclusive schools when mediated by perceptions [REJECTED]

H4 = There is a significant relationship between teacher professional qualification and ICT-enhanced teaching and learning in inclusive schools when mediated by teacher ICT perceptions [ACCEPTED]

The next section discusses these findings with reference to what previous research has found.

5 Discussion and Conclusion

The study explored the impact to which teachers' demographic variables of age, teacher experience and professional qualification have on ICT-enhanced teaching and learning in inclusive schools. The study found that the demographic factor of **age** does not have an impact on ICT-enhanced teaching and learning in inclusive schools regardless of teacher ICT perceptions. This was in disagreement to [27] who found that age, gender and experience had significant relationship with perceptions of ICT competence. [26] observed that as age increases the teacher ICT competence score decreases, in inclusive schools this is not the case as age does not influence ICT perceptions and use even though majority of the respondents were above 44 years. Teacher age may not be a concern for technology use as Becta (2004; 2007) and Scrimshaw (2004) in [21] indicate that 'experienced older teachers have the ability to identify areas where computers can support and extend teaching and learning'. This could be the case in inclusive schools.

Gender did not have an impact on teachers' perceptions. This was a disagreement to [33, 35] who found that gender did have an influence on ICT use and uptake. There were equal mean scores on the dimensions by gender and thus the perceptions were the same for both males and females. In inclusive schools within Johannesburg Central District, gender is not a determinant in distinguishing teachers' perceptions of using ICT in education, teacher competence, professional development and curriculum enhancement. The success of ICT-enhanced teaching and learning is not influenced by the gender cohort of teachers.

[18] found that teacher experience has more influence on teacher's use of technology in the classroom more than age and gender yet this study found that *Teaching experience* does not have an impact on teachers' ICT perceptions in Inclusive Schools. This result means that both the teachers who were part of the teaching cohort before these schools were converted from mainstream to Inclusive Schools and those who have recently joined have the same ICT perceptions. The data also shows that newer teachers in the profession and older teachers have the same perceptions.

Professional qualification has an impact on ICT-enhanced teaching and learning in inclusive schools. This was in agreement with [33] who found that teachers' level of education influences their perceptions and attitudes towards ICT use. Teachers with Bachelor Degrees, even though they were few in number, feel very strongly about obtaining ICT skills for inclusive schools while those with three-year diplomas + teaching experience, who were the majority of the cohort, feel less strong. This could mean that perhaps teachers with higher qualifications have had ICT skills training during their studies or perhaps that their bachelor's qualifications were more recent compared to the older diploma qualifications.

ICT-enhanced teaching and learning in inclusive schools within a developing country like South Africa can benefit from a teacher cohort that has positive views about the use of ICT in the school. ICT interventions and investments by the Gauteng Department of Education (GDE) [12] will be met with ready and confident teacher cohort that is willing to receive ICTs training to enhance their own development so as to be able to teach in these new inclusive settings. Regardless of age, gender or teaching experience, teachers are positive on using ICT to enhance teaching and learning in inclusive schools. A bachelor's degree professional qualification has influence on ICT perceptions of teacher competence as compared to a three-year diploma with + experience. Capacitating teachers in continued professional development can benefit inclusive schools in that teachers may have more confidence in embracing ICT to enhance teaching and learning. Identifying and addressing teacher's personal barriers to inclusive education is a big stand to ICT-enhanced teaching and learning. The next section outlines future research.

6   Limitation and future research

Inclusive education is a developing field in research and an ongoing process in practice. Our main research focus for this rudimentary study was to explore the influence of demographic factors on ICT-enhanced teaching and learning in inclusive schools within Johannesburg Central District, South Africa. There are only four inclusive schools within Johannesburg Central District and these were the population of this study. This study was treated as a case and has a limitations; it is thus not subject to generalisation of the findings. This limits the generalisability of the results. Further research studies should be conducted to investigate teachers' demographic of race as well-as one of the schools was from a coloured community whereas the other three were from a predominantly black community. Also comparative studies can be done between the different districts within Johannesburg as they serve different race groups and the teacher cohort are reflective of the areas they serve. Inclusive schools cater for all types of learners, it would be of great interest to study the influence of teacher disability on ICT-enhanced teaching and learning when mediated by perceptions.

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Appendix

Springer Accepted Publications

(*Abstracts only*)

An INVESTIGATION Of The GOVERNMENT-RELATED FACTORS That INHIBIT SMALL To MEDIUM ENTERPRISES' ADOPTION And EFFECTIVE USE Of INFORMATION And COMMUNICATION TECHNOLOGY In DEVELOPING COUNTRIES: The CASE Of ZIMBABWE

Peter Makiwa[✉][1][0000-0002-0279-4583] and Riana Steyn[2][0000-0002-9841-2497]

[1] University of Pretoria, Department of Informatics, South Africa
pmakiwa@gmail.com
[2] University of Pretoria, Department of Informatics, South Africa
riana.steyn@up.ac.za

Abstract. The utilisation and adoption of information and communication technologies (ICTs) in small to medium enterprises (SMEs) around the world has had a significant effect on most economies, and has resulted in sustainable growth and prosperity. This has led most global governments to develop an interest in the development of SMEs. However, most SMEs in developing countries, including Zimbabwe, are still ages behind their counterparts in developed countries with regard to the application of ICTs in business processes. The reviewed literature for this study indicates that the Zimbabwean government has failed to stimulate the adoption of ICT and its use in Zimbabwean SMEs in recent decades. This paper seeks to reveal key government-related factors and strategies that can lead to the effective adoption of ICTs in the SME sector. A case study, qualitative methodology was employed for this investigation. This facilitated an all-encompassing view of the phenomenon under study. The approach utilised semi-structured interviews to collect data and employed a thematic analysis method. The research findings revealed that key factors that impact on ICT adoption in Zimbabwean SMEs include a lack of government support, poor policy formulation, implementation and awareness, a lack of finances and inadequate infrastructure. Key strategies outlined in this paper include the introduction of ICT import subsidies, tax rebates for SMEs, the formulation of SME-friendly policies, the expansion of electricity and internet infrastructure to marginalised areas, and the establishment of government ICT centres to stimulate the adoption of ICT and its use in SMEs.

Keywords: Small to Medium Enterprise, Information and Communication Technology, Government Policies.

It Should Be There, But It Is Hard to Find: Economic Impact of ICT in Sub-Saharan Economies

Sergey Samoilenko[□1][0000-0002-3551-1279] and Kweku-Muata Osei-Bryson[2][1111-2222-3333-4444]

[1] Averett University, Danville, VA, USA
ssamoilenko@averett.edu
[2] Virginia Commonwealth University, Richmond, VA, USA
kmosei@vcu.edu

Abstract This study relies on a modified framework of Networked Readiness Index to investigate the presence of relationships between the impact of ICT on innovation and productivity on micro- and macroeconomic outcomes. The context of the study is a 3-cluster sample of Sub-Saharan (SSA) economies and the time frame is 2012-2015. The results indicate that SSA economies, as whole, are efficient in translating ICT capabilities into ICT impacts, however, the evidence of efficient translation of ICT impacts into micro- and macroeconomic impacts remains elusive. Furthermore, there is no evidence to suggest that higher levels of relative wealth of SSA economies are associated with higher levels of ICT capabilities. The results of the data analysis suggest that the framework of NRI should be supplemented by other constructs if an investigation targets micro- and macroeconomic impacts of ICT capabilities.

Keywords: Sub-Saharan Economies, Networked Readiness Index, Microeconomic Outcomes, Macroeconomic Outcomes, DEA, Decision Trees, Clustering.

Development Outcomes of Training for Online Freelancing in the Philippines

Karsten Eskelund[1][0000-0002-7001-0091] ✉ , Richard Heeks[2][0000-0002-4551-2208] and Brian Nicholson[1][0000-0002-6729-9874]

[1] Alliance Manchester Business School, University of Manchester, UK
[2] Centre for Development Informatics, University of Manchester, UK
karsten.eskelund@postgrad.manchester.ac.uk

Abstract. Impact sourcing focuses on training and hiring people who would otherwise not be able to land a job in the outsourcing business. The Philippine Government has initiated a training program to prepare people for online freelancing in socio-economically disadvantaged areas in the country.

We lack knowledge about the impact such training programs might have on marginalized individuals. Thus, this paper adds to previous research on impact sourcing by analyzing whether government-initiated training enables people in socio-economically disadvantaged areas to obtain online freelancing jobs. We analyze data from a survey and interviews with the choice framework.

We used an explanatory mixed-methods approach. We used a survey to gather information from the trainees about their perception of the training. We also conducted interviews with trainees in selected locations.

The findings indicate that the trainees gained both technical and personal skills that enabled them to target jobs they previously were not qualified for. However, structural challenges remained, such as a lack of a stable Internet connection in some areas.

This paper adds to previous research about impact sourcing by examining how training can help marginalized people to obtain online freelancing jobs.

Keywords: Employability, digital development, choices, training.

Domestication of ICTs in Community Savings and Credit Associations (Stokvels) in the Western Cape, South Africa

Nokwazi Biyela[1][0000-0001-9353-0833], Pitso Tsibolane[2][0000-0002-7888-1181] and Jean-Paul van Belle[3][0000-0002-9140-0143]

[1] University of Cape Town, Cape Town, South Africa
`BYLNOK004@myuct.ac.za`
[2] University of Cape Town, Cape Town, South Africa
`Pitso.Tsibolane@uct.ac.za`
[3] University of Cape Town, Cape Town, South Africa
`jean-paul.vanbelle@uct.ac.za`

Abstract. The stokvel economy is estimated to be R49 billion in South Africa with more than 810 000 groups consisting of about 11.5 million members. This study aimed to discover how stokvel members domesticate information communication technologies (ICTs). Domestication theory was used as a theoretical lens for this study. The study used semi-structured interviews to collect data from a sample of 20 stokvel members of 20 different groups of stokvels in Cape Town. The qualitative data was analyzed using the thematic analysis. The findings revealed that stokvel members use ICTs such as mobile phones, spreadsheet applications (Excel), mobile banking, social media communications (mostly WhatsApp) and e-mail (for those that are employed) in the running of their operations. The members indicated that the use of WhatsApp enables them to reduce the amount of times they have to meet on a face to face basis as they did before. They also use technology to send money through mobile money transfer services and banks. Age influenced the adoption of ICTs amongst stokvel members i.e. older members seem resistant to the use of technology. This study makes a contribution to the discourse on digital financial inclusion as well as a contribution to practice by providing empirically grounded insights regarding ICT use behavior patterns among members of informal savings and credit associations.

Keywords: ICT4D, Savings and Credit Associations, Stokvel, Domestication.

Global Standards and Local Development

Simon Pettersen Nguyen ✉ [1][0000-0001-8782-9484], Petter Nielsen[2][0000-0003-3723-6976] and

Johan Ivar Sæbø[3][0000-0001-9873-4544]

Department of Informatics, University of Oslo, Oslo, Norway
{simonpn, pnielsen, johansa}@ifi.uio.no

Abstract. Substantial investments are made in ICTs to support socioeconomic growth in developing countries. As a side-effect of this, the public health sectors in developing countries are commonly challenged by the proliferation of multiple and parallel information systems. Investments are made, but not in a coordinated manner. Based on a case study of OpenHIE, a global community of practice supporting the development of ICT standards within health and the implementation of these standards in Tanzania and The Philippines, we discuss the relation between global standards and local development. We do so by conceptualizing the global standards offered by OpenHIE as fluid standards and standards as composed of a package of the different components necessary to make them globally and locally relevant. Theoretically, we contribute to the standardization literature by applying and expanding the concept of fluid standards within this particular context of global initiatives to reduce fragmentation of health information systems locally in developing countries. We also contribute to the development literature by exemplifying and critically discussing how the fluid nature of standards and the networked nature of standardization processes promote local development.

Keywords: Standards, Standardization, Global Standards, OpenHIE, Fluid Standards, Health Information Exchange, Interoperability.

Identifying the Constructs and Agile Capabilities of Data Governance and Data Management: A Review of the Literature

Theresa Lillie[1][0000-0002-1989-3297] and Sunet Eybers[2][0000-0002-0545-3688] ✉

[1] University of Pretoria, Private Bag X20, Hatfield, South Africa, 0028
tessa.lillie@wol.co.za
[2] University of Pretoria, Private Bag X20, Hatfield, South Africa, 0028
sunet.eybers@up.ac.za

Abstract. Data has become an invaluable asset to organizations. However, it is evident from the existing literature that despite the increased awareness of the importance of their data assets, many organizations fail to manage and govern these assets with the agility required in a highly competitive and volatile business environment. For data governance to be effective and sustainable in a turbulent, increasingly regulated, and competitive organizational environment, all of the elements of data governance should enable and support agility in the organization's management of its data and information assets. As a result of increased local and global data regulations, a high reliance on technical skills, and economic constraints, organizations in developing countries have experienced challenges with implementing data governance programs. Governance within an organization comprises the internal processes and policies that enable human capital performance, legal and regulatory compliance and organizational alignment. There is no single approach to achieving successful data governance, and factors pertaining to the organization's strategy, structure, business requirements and culture need to be considered. In this study a systematic review of existing academic literature was conducted to investigate (1) the scope and constructs of data governance and data management, (2) the agile capabilities that are required in data governance and data management for the timeous delivery of useful data to business, and (3) the need for African organizations to establish agile capabilities in their data governance and data management functions. The results of this review should be helpful with assisting organizations in African countries to achieve agility in the governance and management of data that supports business requirements and organizational agility.

Keywords: Data governance, data management, organizational agility, agile governance, complex adaptive systems, agile capabilities.

The Role of Local *Bricoleurs* in Sustaining Changing ICT4D Solutions

Fruijtier, Elisabeth(✉) [0000-0002-5914-6608] and Senyoni, Wilfred [0000-0001-6030-6050]

University of Oslo, Blindern 0317, Norway
fruijtie[at]tcd.ie
senyoni@gmail.com

Abstract. This paper problematises the way ICT4D projects are rarely equipped to anticipate for the longitudinal and organic nature of ICT4D processes. As such, it aims to explore how these ever-evolving processes may be met with adaptive solutions that are responsive to their changing environments. Our analysis concentrated on uncovering the change processes of a particularly successful ICT4D implementation over time. Based on these findings, we develop a process perspective of bricolage-driven change in ICT4D in which bricolage practices move through 3 different stages we identify to be 'opportunity based', 'locally owned' and 'locally driven' in nature. These insights are aimed at aiding researchers as well as practitioners in the ICT4D domain in the implementation of long term ICT4D solutions.

Keywords: ICT4D, Bricolage, Sustainability, Change.

The Role of the Marginalized and Unusual Suspects in the Production of Digital Innovations: Models of Innovation in an African Context

Paul Mungai[1][0000-0002-9427-500X], Andrea Jimenez[2][0000-0002-2166-8574], Dorothea Kleine[3][0000-0002-6847-8807], and Jean-Paul Van Belle[4][0000-0002-9140-0143][✉]

[1,4] University of Cape Town
[4]jean-paul.vanbelle@uct.ac.za
[2,3] University of Sheffield
[3]d.j.kleine@sheffield.ac.uk

Abstract.

The rapid proliferation of innovation concepts addressing experiences in the Global South raises crucial questions about the relevance of this phenomenon for development. In an effort to bring conceptual clarity, this paper reviews several related understandings of innovation and related approaches to firstly map overlaps and differences and secondly understand how they are situated within the development discourse. This study uses a literature review and applies thematic analysis in identifying the various innovation concepts, and the extent to which they include the marginalized in their framing and operationalization. In particular, this study evaluates whether these innovation concepts are framing innovation as something developed outside of poor communities but on behalf of them; whether innovation is designed alongside poor communities; or whether it is designed by and within poor communities. The findings of this study revealed that in most cases, these concepts are pro-poor, with very few exceptions of innovations done in collaboration with the poor, in a per-poor process.

Keywords: Innovation models, digital innovation, development, marginalized, Africa.

Supporting the Identification of Victims of Human Trafficking and Forced Labor in Thailand

Hannah Thinyane [0000-0003-0491-4048]

United Nations University, Institute on Computing and Society. Macau SAR, China
hannah@unu.edu

Abstract. We present results from a mixed methods study, involving survey data collection, and focus groups to understand the current processes of identifying victims of human trafficking in Thailand. Participants represent a broad spectrum of inter-governmental organizations, regional and local NGOs, Thai government officials, translators, and previously exploited migrant workers. Across these different stakeholders, participants' identified key problems of: lack of trust, communication issues, and differences in understanding of the key indicators of human trafficking between parties. The study also highlighted participants' perceptions on the role that technology can play to address the problems they face in identifying victims. It identifies the use of a smart phone application on the NGO or frontline responder's own device as a potential facility to enable workers in vulnerable situations to self-identify and seek help; allowing them to bridge the communication and skills divide with the channels of help that already exist.

Keywords: mixed methods study, labor exploitation and human trafficking, computer supported communication.

Building Empathy for Design Thinking in e-Health: A Zimbabwean Case Study

Masiya Alex Marufu [1] and Alta van der Merwe [2]

University of Pretoria, Informatics Dept, Lynnwood Road, Pretoria, South Africa
✉alexmarufu@gmail.com; alta@up.ac.za

Abstract. The challenges of healthcare delivery in Africa are well documented. Advances in technology present an opportunity to address some of these challenges in a cost effective manner. Notwithstanding these advances, many initiatives that are initiated fail to deliver the desired benefits, with a lack of citizen engagement being cited as one of the reasons for this failure. Design thinking is an approach to innovation that places human needs at the centre of design by gaining empathy with those for whom designs are initiated. This paper reports on the empathy building conducted in trying to understand the needs of mothers seeking post-natal care in a low-income neighbourhood in Zimbabwe. Through interviews, observations, and journals; using service-dominant logic theory to analyse the output; a picture emerges of the lives of the mothers and babies, and their interaction with the healthcare system. Working in teams with mobile application developers and nurses, the mothers participate in a workshop that produces points of view that define problems the teams would like addressed through the use of technology in a design thinking exercise.

This paper reports on the work of hospital midwives and chronicles the lives of several mothers in the eight weeks after giving birth. It also sets out four design challenges based on the points of view that are derived from the design thinking workshops.

Keywords: Design Thinking, e-Health, Service Dominant Logic, Zimbabwe.

[1] ORCID : 0000-0002-1723-8168
[2] ORCID : 0000-0002-3652-7512

Investigating Business Intelligence (BI) Maturity in an African Developing Country: A Mozambican Study

S. Eybers[1][0000-0002-0545-3688], M.J. Hattingh[2][0000-0003-1121-8892] and O.M.P. Zandamela[3][0000-0002-2198-928]

University of Pretoria, Private Bag X20, Hatfield, 0028, {✉[1] `sunet.eybers`, [2]`marie.hattingh`}`@up.ac.za`
[3] University of South Africa, P.O. Box 392, Unisa, 0003,
`Osvaldo.Zandamela@south32.net`

Abstract. The term 'Big Data' has placed renewed focus on the untapped value of data in organisations. Despite the hype of Big Data and the obvious benefits associated with it, organisations often battle with dealing with 'normal' transactional data, obtained from various information systems to make vital business decisions. The objective of this qualitative study was to investigate the extent to which Business Intelligence System (BIS) were implemented in a developing country such as Mozambique through the lens of organizational maturity. Maturity assessment is a popular method for assessing the readiness of an organisations by means of processes, people and data toward the adoption of a particular approach. In this instance, the Business Intelligence maturity model (biMM) developed by Dinter [1] was adopted to establish the BI maturity in the Mozambican oganisations for the purpose of comparing results. The study found that high maturity levels were achieved in the integration between technological production and development infrastructure and the availability of BIS in organisations. However, huge challenges were faced in the area of metadata management, master data management, low level access and support of analytical information to operational business processes.

The findings make an important contribution towards understanding the BIS maturity level of Mozambican organisations for the purpose of future data related technological adoptions.

Keywords: Business Intelligence Systems (BIS), BIS Maturity, Developing Country.

The Project Management Information System as Enabler for ICT4D Achievement at Capability Maturity Level 2 and Above

[1] Mark Jonathan Corrigan ✉ [0000-0002-0683-866X] and [2] John Andrew van der Poll [0000-0001-6557-7749] and [3] Emmanuel Samuel Mtsweni [0000-0001-5030-8351]

[1] School of Computing, University of South Africa, Phapha Building, 2nd Floor Science Campus, Cnr Christiaan de Wet & Pioneer Streets Florida,
4151690@mylife.unisa.ac.za

[2] Graduate School of Business Leadership, University of South Africa, Cnr Janadel and Alexandra Avenues, Midrand, South Africa,
vdpolja@unisa.ac.za

[3] School of Computing, University of South Africa, G J Grewel Building, 3rd Floor Science Campus, Cnr Christiaan de Wet & Pioneer Streets Florida,
mtswees@unisa.ac.za

Abstract. Current trends project management promote Agile as a solution for challenges around project delivery, focusing more on individuals and interactions than on processes and tools. This paper postulates that any project method, especially agile, if undertaken with limited process focus below Capability Maturity level 2, may well result in project delivery failures, despite best intentions from the project team. With dynamic internet growth in developing countries and advancements in virtual collaboration, projects ought to involve tailoring jointly-agreed project management processes at Capability Maturity level 2 and above. In addition, the utilization of a Project Management Information System emplacement is essential for project management success. The use of a PMIS is in line with a process-driven approach to ICT4D and will facilitate the ICT value proposition for a developing economy. Following a comprehensive literature review, the paper asserts that Capability Maturity level 2 will remain relatively unattainable unless the Project Management Information System emplacement becomes a strategic driver for success. To this end we propose a PMIS CM Improvement Framework to the PMBOK Process Group and Knowledge Area matrix and establish the value proposition for ICT4D.

Keywords: ICT4D, agile, capability maturity levels, chaos, productivity, theory of constraints, project management, process management, project management information system, software engineering, earned value management, value proposition.

Youth Unemployment in South Africa and the Socio-economic Capabilities from Mobile Phones

Hossana Twinomurinzi[✉]1 [0000-0002-9811-3358] and Joshua Magundini[1][0000-0002-4139-2691]

[1] School of Computing, University of South Africa, South Africa
twinoh@unisa.ac.za

Abstract. Unemployment is a significant global challenge with major social and economic implications. Unemployment has however not prevented the youth from owning and using mobile devices nor other Information and Communication Technologies (ICT). This exploratory paper investigated the mobile usage patterns among 104 participants in an effort to contextualize mobile and ICT strategies that target unemployed youth. The exploratory findings suggest that contrary to the assumption of most ICT for development literature to target youth in rural areas, ICT strategies targeting youth unemployment may be more effective when targeted at youth in urban areas. The strategies may also need to be adjusted as the youth tend towards the age of 35 where they become apathetic about job opportunities. Two capabilities, 'individual' and 'interpersonal', emerged uniquely as the job related economic capabilities of ICT. The paper contributes to practice and theory in suggesting recommendations for further research for ICT skills development programmes targeted at youth.

Keywords: ICT4D, ICT skills, Mobile Usage, Youth, Youth Unemployment, South Africa.

Smartphone Paradoxes in Working Mothers' Pursuit of Work-Life Balance

Karen Sowon ✉ [1] [0000-0001-7052-4406], Olga Sikhwari[2] [0000-0001-8251-6382], Mphatso Nyemba-Mudenda[3] [0000-0001-6288-7274] and Wallace Chigona[4] [0000-0002-1059-811X]

[1] Department of Information Systems, University of Cape Town, South Africa
csowon@gmail.com
[2] Department of Information Systems, University of Cape Town, South Africa
skholg001@gmail.com
[3] Department of Information Systems, University of Cape Town, South Africa
mphatsonyemba@yahoo.com
[4] Department of Information Systems, University of Cape Town, South Africa
wallace.chigona@uct.ac.za

Abstract. Technology has led to the intertwining of work and life with persistent debates as to whether they facilitate better Work-Life Balance (WLB) practices or not. It is argued that while smartphones may provide capabilities that foster WLB, they may also contribute to negative outcomes that challenge the very pursuit and intention of WLB. The research adopts an interpretive qualitative approach using the paradoxes of technology to understand what conflicts the use of smartphones present to working mothers in their pursuit if WLB . A total of 15 participants were selected through convenience sampling to study a variety of experiences and views regarding smartphones as experienced by working mothers. The sample differed in terms of age, marital status, type of employment, industry and income level. We used semi-structured interviews to collect data. The data were analyzed using thematic analysis. The results indicate that though smartphones provide capabilities that potentially support WLB, their very use result in paradoxical experiences for mothers that challenge their very quest of WLB.

Keywords: Work-life balance, working mothers, technology paradox.

A Qualitative Analysis of an E-education Initiative in Deep Rural Schools in South Africa: A Need to Build Resilience

Sifiso Dlamini[1] [0000-0002-3756-4980], Abraham van der Vyver[2] [0000-0002-3756-4980]

[1]CSIR Meraka Institute, Meiring Naude Rd Pretoria, South Africa,
✉sdlamini@csir.co.za

[2]Monash South Africa, 144 Peter Road Rooderpoort, South Africa
braam.vandervyver@monash.edu

Abstract: The Information Communication and Technology for Rural Education Development (ICT4RED) initiative in South Africa which was aimed at the introduction of ICTs into schools in disadvantaged communities was coordinated by a government agency (The Meraka Institute). The initiative was supported by a number of government stakeholders namely the Department of Science and Technology, the Department of Basic Education, the Department of Rural Development and Land Reform, and the Provincial Department of Education. Often ICT4E projects fail once the implementation team and the funder withdraw, especially in rural schools where the only technological resources to be ever available at the school were the one provided through the project or intervention. Although there are multiple reasons for this, the problem often lies with integration of the project into the day-to-day institutional arrangements of the education system. This puts pressure on the school environment, especially the teacher who often receives little support from the District and Provincial Department. The researchers conducted semi-structured interviews with eleven teachers from five project schools who were selected for an evaluation at the time in the Eastern Cape province of South Africa. Findings on the paper were generated by way of content analysis. The content of the interviews was finally analysed with Heeks's Resilience Assessment Benchmarking and Impact Toolkit (RABIT). The research showed that these schools are unable to sustain the change introduced without support from their formal support system; therefore this indicates that schools are required to be more resilient in order to develop capacity to absorb the intervention and to successfully implement it at the school level.

Keywords: ICT4E, Resilience, Sustainability, Implementation.

Enablers of Egalitarian Participation: Case Studies in Underserved Communities in South Africa. Processes of Creativity "Not for the Sake of it"

Maria Rosa Lorini[1][0000-0002-0031-657X], Wallace Chigona[2][0000-0002-1059-811X] and Malcolm Garbutt[3][0000-0002-0781-0415]

[1,2,3] University of Cape Town, Rondebosch 7701, Cape Town, South Africa

mariarosalorini@gmail.com

Abstract. Although ICT4D impacts peoples' lives, drivers for change are often from a self-serving perspective and not sustainable due to lack of buy-in in the affected communities. To overcome this ICT4D must move from laboratory approaches and collaboration to grassroots innovation with communities designing their use of ICT. This study presents three cases of ICT4D projects in underserved communities in Cape Town, South Africa with the aim of determining enablers of egalitarian participation to support grassroots innovations. Egalitarian participation encourages acquiring self-confidence and empowerment while remaining motivated to be part of the process. In the processes analysed, an emergent approach characterised by openness, relaxed rules, and flexibility allowed participants to work on their skills, to increase confidence in their capabilities and to evaluate new opportunities. The primary outcome of an approach based on relationships and not on design rules, promoted inclusive participation. Collectives engaged in processes and developed self-determined behaviours and cohesion in supporting their communities. The social goal of the activities where creativity developed 'not for the sake of it' backed the main aim of the egalitarian approach: involving the community and creating ownership. Analysis of the cases highlighted methodological patterns that could potentially be replicated which are presented as enablers for egalitarian participation in underserved communities. In contrast to the approach of purely supplying solutions, a reflexive approach permeated by the principles of mutual learning and solidarity was observed which evolved into grassroots innovations.

Keywords: Co-design, community participation, co-creation, inclusive participation, grassroots.

Localize-It: Co-Designing a Community-owned Platform

Maria Rosa Lorini[□][1][0000-0002-0031-657X], Melissa Densmore [2][0000-0003-1733-2653], David Johnson[3][0000-0002-7128-4966], Senka Hadzic[4][0000-0003-4531-791X], Hafeni Mthoko[5][0000-0003-4949-2336], Ganief Manuel[6][0000-0002-2033-5540], Marius Waries[7][0000-0001-6388-4729], André van Zyl[8][0000-0002-2212-0586]

[1,2,3,4,5] University of Cape Town, Rondebosch 7701, Cape Town, South Africa

[6,7,8] Ocean View Community Representative, Ocean View 4052, Cape Town, South Africa

□ mariarosalorini@gmail.com

Abstract. One of the most difficult, yet undocumented, aspects of information and communications technologies and development (ICTD) projects is that of establishing partnerships around which researcher's interventions will develop, be tested and grow. Constraints on timing and funding usually lead to short-term projects, in which benefits are biased towards researchers rather than the partner community. In order to avoid empty and unethical promises and to increase the potential benefit for the community, we consider the process of developing participatory partnerships in ICTD projects. The objective is to make the project community-owned, allowing the participants to develop what they value as important. Using the case of a township-based wireless community content sharing network, we describe the potential and some of the challenges with this approach. The paper highlights building blocks, such as ethical behaviour and trust, to avoid recreating the dichotomy between research and practice and building a constructive collaboration.

Keywords: ICTD, Partnership, Community Wireless, Ownership.

Rethinking ICT4D Impact Assessments: Reflections from the Siyakhula Living Lab in South Africa

Hafeni Mthoko[1][0000-0003-4949-2336] and Caroline Khene[2][0000-0001-5673-8061]

[1] University of Cape Town, Cape Town, South Africa
✉ hafeni.mthoko@uct.ac.za
[2] Rhodes University, Grahamstown, South Africa
c.khene@ru.ac.za

Abstract. The approach to outcome and impact assessments of ICTD has often relied solely on identifying project effects in relation to project baseline data. However, such an approach limits the potential learning that could be occurring throughout a project's lifecycle. Impact assessments should be conducted in a comprehensive manner, taking into account the evaluation data that has been captured from the initiation of the project through to its implementation, and beyond. The study sought to reflect on the implementation of an impact assessment framework that is based on a comprehensive approach to evaluation. The framework was implemented in the Siyakhula Living Lab to assess for its outcomes and impacts on the community. A pragmatist approach was applied through a reflective process to assess the utility of the framework within this context. Semi-structured interviews with project stakeholders where conducted to further gain insights on the comprehensive approach to conducting impact assessments. It was found that a comprehensive approach to assessing impacts provided a meaningful way to understand the effects of the ICTD initiative and provided an overview of project areas that required improvement. However, it was found that the proposed assessment framework required a customization component in order to modify it to better suit the project context. The way in which future impact assessments are conducted can draw on the lessons gained from following a more comprehensive approach to evaluation and thus improve learning overtime.

Keywords: Impact Assessment, Evaluation, Learning, Living Lab, Sustainability.

Coming to terms with Telemetry: A scoping review

M.Weiss [1][0000-0002-8084-2739]; A.Botha [2][0000-0002-1147-1380] & M.Herselman [2][0000-0003-1089-3925]

[1]Jembi health systems NPC, and SAMRC
[2]CSIR Meraka & UNISA, School of Computing, South Africa

Abstract. MHealth solutions, in resource constrained public healthcare settings, are often an extension of the reach of the government health system. As such, mHealth is subjected to demands resulting from, not only restrictions due to constrained health service offerings but technically constrained limitations inherent in the provisioning of said services as well. Telemetry may be able to offer a workable strategy in mitigating some of these. Technical constraints. Telemetry, in various guises, has been in use since 1912. The term is used in Information Systems to refer to a conceptual understanding of remote monitoring and control. The concept morphs from its initial concept of Supervisory, Control, and Data Acquisition (SCADA), to often become synonymous with more evolving trends such as machine-to-machine (M2M) and the Internet of Things (IoT). Where there is a clearer understanding of the domain differences between the latter two, Telemetry, in contrast, is poorly expanded on and is predominantly used to denote the features in and of a system. As such, the agreement of what constitute the components of a telemetry system, or a telemetry framework, is implicitly referred to from within reports and case studies. It follows that the notion of a telemetry framework or, telemetry perspective, is inferred by its context and changes as its conceptual application changes. This paper aims to articulate the components for a Telemetry implementation from literature and to suggest design criteria that could be considered for a mHealth telemetry implementation.

Keywords: Telemetry, SCADA, IoT, M2M, mHealth, Resource Constrained

Towards a Provisional Workplace E-learning Acceptance Framework for Developing Countries

Mc Donald van der Merwe [0000-0002-0710-3366] ✉ and Gavin Armitage

Department of Information Systems, University of South Africa,
Corner of Christiaan de Wet Road and Pioneer Avenue, Florida, South Africa
vdmertm@unisa.ac.za, gavin.a.armitage@gmail.com

Abstract. Using the available literature and existing critical success factors models and frameworks as bases, this paper proposes a provisional workplace e-learning acceptance framework for developing countries. The intended outcome was to evaluate whether or not the framework appropriates employee acceptance of current e-learning initiatives. The study was conducted by means of a survey questionnaire that was distributed to three South African organisations that already make use of e-learning. Categories User characteristics, Technology influence and Instructor influence returned an average median that reflected a general agreement with positive statements about e-learning initiatives offered. Respondents were, however, less enthusiastic about the category Support influence, which returned a lower average median. Whereas several individual tensions were identified across categories, these did not have a pronounced impact on the category Overall acceptance of e-learning. The latter finding provided preliminary evidence that the proposed framework, at minimum, established priorities that may in time contribute to the establishment of a validated framework for developing countries.

Keywords: Workplace E-learning, Acceptance Framework, Critical Success Factors, Technology Acceptance Model.