THE AFRICAN JOURNAL OF INFORMATION AND COMMUNICATION (AJIC)

ISSUE 21, 2018

ARTICLES

Published by the LINK Centre
University of the Witwatersrand (Wits)
Johannesburg, South Africa
www.wits.ac.za/linkcentre

ISSN 2077-7213 (online version)
ISSN 2077-7205 (print version)

The African Journal of Information and Communication (AJIC)

Issue 21, 2018

Published by the LINK Centre, School of Literature, Language and Media (SLLM)
Faculty of Humanities, University of the Witwatersrand (Wits)
Johannesburg, South Africa
www.wits.ac.za/linkcentre/ajic

Published since 2000, *The African Journal of Information and Communication (AJIC)* is a peer-reviewed, interdisciplinary, open access academic journal focused on information and communication ecosystems in Africa, elsewhere in the developing world, at at global level. Accredited by the South African Department of Higher Education and Training (DHET), *AJIC* pursues its open access objective by publishing online, free to the user, under a Creative Commons licence, and by not imposing article processing charges on its contributors.

Editorial Advisory Board

The journal is supported by an international editorial advisory board, comprising:
Lucienne Abrahams, University of the Witwatersrand, Johannesburg, South Africa
Hatem Elkadi, University of Cairo, Egypt
Nagy K Hanna, author and international development strategist, Washington, DC, US
Joseph Kizza, University of Tennessee, Chattanooga, TN, US
Tawana Kupe, University of the Witwatersrand, Johannesburg, South Africa
Gillian Marcelle, University of the Virgin Islands, St Thomas, US Virgin Islands
Uche M Mbanaso, Nasarawa State University, Keffi, Nigeria
Caroline Ncube, University of Cape Town, South Africa
Ewan Sutherland, University of the Witwatersrand, Johannesburg, South Africa

Editors

Managing Editor: Tawana Kupe, Vice-Principal, Deputy Vice-Chancellor and Professor, University of the Witwatersrand, Johannesburg, South Africa, tawana.kupe@wits.ac.za

Corresponding Editor: Lucienne Abrahams, Director, LINK Centre, Faculty of Humanities, University of the Witwatersrand, PO Box 601, Wits 2050, Johannesburg, South Africa, ajic.submissions@gmail.com

Publishing Editor: Chris Armstrong, Visiting Fellow, LINK Centre, University of the Witwatersrand, Johannesburg, South Africa, chris.armstrong@wits.ac.za

Peer-Reviewing
AJIC acknowledges with gratitude the following peer reviewers of articles in this issue: Lucienne Abrahams, Chris Armstrong, Barry Dwolatzky, Nagy Hanna, Kiru Pillay, Raj Siriram, and Aaron Van Klyton.

Production
Sub-editing: LINK Centre
Desktop-publishing: LINK Centre

DOI: https://doi.org/10.23962/10539/26116

Recommended citation:
AJIC. (2018). *The African Journal of Information and Communication (AJIC)*, *21*.
https://doi.org/10.23962/10539/26116

This work is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence:
http://creativecommons.org/licenses/by/4.0

ISSN 2077-7213 (online version)
ISSN 2077-7205 (print version)

AJIC is published by the LINK Centre, School of Literature, Language and Media (SLLM), Faculty of Humanities, University of the Witwatersrand (Wits), PO Box 601, Wits 2050, Johannesburg, South Africa. The LINK Centre is headquartered at the Wits Tshimologong Digital Innovation Precinct, 41 Juta St., Braamfontein, Johannesburg, www.tshimologong.joburg

Past issues of *AJIC*, and its precursors *The Southern African Journal of Information and Communication* and *The South African Journal of Information and Communication*, are available at www.wits.ac.za/linkcentre/ajic

CONTENTS

ARTICLES

ARTICLES

Treatment of Kenya's Internet Intermediaries under the Computer Misuse and Cybercrimes Act, 2018

John Walubengo
Lecturer, Multimedia University of Kenya, Nairobi

Mercy Mutemi
Advocate of the High Court of Kenya, Mutemi Sumbi Law, Nairobi

Abstract
Kenya has this year enacted the Computer Misuse and Cybercrimes Act, 2018. This article reviews the Act from the perspective of internet intermediaries, with a view to establishing the impact the Act is expected to have on intermediaries' operations. The article outlines key concerns regarding the Act's provisions in respect of obligations and liabilities of intermediaries, particularly with regard to obligations to support state agencies. Recommendations are made for how the Act could be amended to cater more optimally to both state and intermediary concerns.

Keywords
Computer Misuse and Cybercrimes Act, Kenya, internet intermediaries, intermediary liability, cybercrime

DOI: https://doi.org/10.23962/10539/26114

Recommended citation
Walubengo, J., & Mutemi, M. (2018). Treatment of Kenya's internet intermediaries under the Computer Misuse and Cybercrimes Act, 2018. *The African Journal of Information and Communication (AJIC)*, *21*, 1–19. https://doi.org/10.23962/10539/26114

Acknowledgement
Funding for the research presented in this article was provided by the African Academic Network on Internet Policy (AANoIP).

This article is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence: http://creativecommons.org/licenses/by/4.0

1. Introduction

The internet landscape in Kenya has undergone a profound transformation. Gone are the days of control by a single monopoly offering an inadequate, failure-prone and expensive internet (Ndemo & Weiss, 2016, p. 35). The internet is now a transformative agent that has permeated every economic activity in the country, while redefining the dynamics of social engagement.

According to the Communications Authority (2018), Kenya has 51.1 million internet users, a penetration level of 112.7%.[1] This ubiquity comes, however, with an increase in cybercrime incidents targeting the government, financial institutions, telecommunication entities, individuals, and online platforms. The cost of cybercrime in Kenya in 2017 was estimated at KES21 billion (Serianu, 2017). Where this problem has arisen in other jurisdictions, governments have stepped in to regulate online behaviour and punish bad actors. Kenya's regulatory attempts have seen the enactment of the Computer Misuse and Cybercrimes Act, 2018 (hereinafter the "2018 Act"). This article critically examines the provisions of this Act in respect of the obligations and liability it imposes on internet intermediaries.

2. Legislative context

The 2018 Act is not the first legislative attempt by the Kenyan government to control activities in the information and communication technology (ICT) space. In 1998, the Kenya Communications Act promised a new dawn for the telecommunication industry. That Act of 1998 liberalised the telecommunications sector out of the monopoly of the former Kenya Posts and Telecommunications Corporation, a government monopoly that was unable at the time to provide telephone services to a majority of the population (Republic of Kenya, 1998a). While encouraging privatisation and investment in the telecommunications sector, the Act also dwelled substantially on the issue of licensing, including matters of liability of licensees, thus marking the beginning of regulation of intermediaries. The issue of illegal use of communications infrastructure arose when that 1998 Act was under consideration. The lawmakers' concern at the time was the tapping of telephones (Republic of Kenya, 1998a).

A decade later, in 2008, the country's focus had shifted from telephone and postal services to crafting a more comprehensive ICT and e-commerce framework (Republic of Kenya, 2008). Kenya was, at the time, recovering from its post-election violence of late 2007 and early 2008, and there was consensus that messages spread via text and online had not only catalysed ethnic hatred but also rallied mobs to participate in the ensuing violence (Cheeseman, 2008). The 1998 Act was thus amended in 2008 to

1 Estimated internet penetration exceeds 100% due to many Kenyans having more than one internet connection, i.e., internet penetration is calculated in terms of the combined total number of mobile data/internet subscriptions, terrestrial wireless subscriptions, and fibre optic and satellite subscriptions.

address these challenges by publishing regulations on the prevention of transmission of undesirable bulk political messages. Matters of intermediary liability arose again in 2013 via the Kenya Information and Communications (Amendment) Act, 2013, which required mandatory registration of mobile phone subscribers (Republic of Kenya, 2013). Yet another key development at this stage was the amendment of the Evidence Act of 1963 to allow courts to admit electronic material into evidence (Republic of Kenya, 1963).

Simultaneously, the National Cohesion and Integration Act, 2008 was passed (Republic of Kenya, 2008b). By it, the legislature began prescribing content offences. The offences of hate speech (sect. 13) and ethnic or racial contempt (sect. 62) in the National Cohesion and Integration Act can be seen as targeting primary offenders. However, the Act's use of the words "distribute", "publish" and "provide", in describing the actions that can lead to the offence of hate speech, leave some latitude for inclusion of intermediaries as offenders as well. Further, Section 62(2) of that Act provides for the offence of ethnic or racial contempt as a strict liability offence by "media enterprises", without offering further guidance on what a media enterprise is. And section 57 creates the compliance notice system whereby the National Cohesion and Integration Commission can demand that an intermediary disrupt access to impugned material.

Currently, offences committed over the internet are dealt with under the Kenya Information and Communications Act (KICA), 1998 and the Penal Code. The offences under KICA are tripartite: offences by the intermediaries themselves, offences against the investments made by intermediaries, and substantive offences arising out of the use of computer systems. This third category criminalises unauthorised access to, interception of, and interference with, computer systems, and goes a step farther to prescribe two content offences: improper use of a system, and obscene publication. The High Court of Kenya has since declared, in a 2016 ruling, the first of these two, the offence of improper use of system, unconstitutional, casting doubt on whether the latter would hold if challenged in court.[2] Most of these offences are repealed by section 69 of the 2018 Act. The investigation procedures under Part VII of the Act relate to investigations of entities providing telecommunication services without licences. The Act is quiet on the role of intermediaries in investigation of content offences and misses an opportunity to delimit the extent of intermediary liability.

The Penal Code is applicable to online conduct that is forbidden offline and for which a penalty is spelt out in the Code. This exemplifies (see Best, 2004) the internet governance maxim that says what is illegal offline is illegal online, hence no need to come up with a new offence to cover online conduct.

2 See *George Andare v the Attorney General & 2 Others* [2016].

3. Computer Misuse and Cybercrimes Act, 2018

In its recital, the 2018 Act spells out its purposes as: to provide for offences relating to computer systems; to enable timely and effective detection, investigation and prosecution of computer crimes and cybercrimes; and to facilitate international cooperation in dealing with computer and cybercrime matters. To these ends, the Act introduces several offences.

The first category of offences comprises unauthorised access,[3] access with intent to commit a further offence,[4] unauthorised interference,[5] unauthorised interception,[6] provision and use of illegal devices and access codes,[7] and unauthorised disclosure of passwords.[8] These offences are standard in cybercrime legislation (see ITU, 2017; Council of Europe Budapest Convention, 2001).

Most of these offences were not provided for in KICA. Neither do they fit into the categories of offences of stealing, robbery, breaking and entering, and false pretences that are provided for in the Penal Code. Criminalising such conduct can therefore be welcomed by all internet users, including intermediaries who often find themselves victims of cybercrime (*Business Daily*, 2018).Through the Act, offending online conduct can now form the basis of a sustainable criminal charge.

Sections 20 and 21 of the 2018 Act give intermediaries additional reasons to be happy. Section 20 imposes an enhanced penalty when the offence involves a "protected system", i.e., a system for the provision of communication and financial services and payment systems. Section 21 creates the offence of "cyber espionage", which ought to insulate intermediaries from predatory business practices by competitors, and from espionage as a service (EaaS). EaaS is an emerging threat that allows hackers to lease attack tools from the cloud rather than create them from scratch.

The second category of offences introduced by the Act is content offences. Section 22 makes it a crime to publish false information with the intent that the information be acted on as authentic. Freedom of expression as guaranteed in Article 33 of the 2010 Constitution of Kenya protects publication of all kinds subject to the limitations listed in Articles 33(2)[9] and (3).[10] The section, while well-intended, falls

3 Section 15.
4 Section 15.
5 Section 16.
6 Section 17.
7 Section 18.
8 Section 19.
9 The right to freedom of expression in the Constitution does not extend to propaganda for war, incitement to violence, hate speech or advocacy of hatred that constitutes ethnic incitement, vilification of others or incitement to cause harm; or is based on any ground of discrimination specified or contemplated in Article 27(4).
10 According to the Constitution, in the exercise of the right to freedom of expression, every person shall respect the rights and reputation of others.

outside the scope of allowable limitations to freedom of expression. Another glaring shortcoming of this Section is the failure to define what constitutes publication. Clarity to this end would shield intermediaries from secondary liability that often arises in content offences (Dinwoodie, 2017).

Sections 24 of the Act sets out the offence of child pornography. This is an improvement on section 16 of the Sexual Offences Act, 2006 (Republic of Kenya, 2006). Unlike the latter, the 2018 Act forbids the delivery, transmission, or distribution of the material in question, or making the same available in any way. Also forbidden is the possession of child pornographic material in a computer system or computer data storage medium. This general proscription may present problems for intermediaries, although a majority of intermediaries already have a zero-tolerance policy towards child pornography (Technology Coalition, 2015).

The 2018 Act also addresses the offences of computer forgery and computer fraud. The elements of computer forgery under section 25 are sufficiently comprehensive to cover social-engineering attacks. Section 26 creates the offence of computer fraud. The harassment offences of cyberstalking and cyberbullying are included in section 27 of the Act—a laudable inclusion to prevent internet users from conduct that has detrimental effects on victims as described by (Englander et al., 2017).

Part IV of the Act lays out the investigation procedures to be undertaken in obtaining evidentiary material in computer systems, subscriber information, traffic data and content data. Part V addresses international cooperation in cybercrime investigations. These two parts are discussed in detail later in this article.

4. Intermediary liability

An exposition on cybercrime is incomplete without detailing the role of intermediaries. Crimes committed over the internet are difficult to detect and prosecute. For one, delinquent internet users enjoy anonymity which can be achieved in various ways. These vary from the use of pseudonyms and encryption, the use of virtual networks and proxy servers to mask internet protocol (IP) addresses, and the deletion of posts and clearing of cookies and browser history (Rainie, 2013). Second, security threats are now extremely complex, ranging from data interception, data interference, and illegal access to systems, to installation of spyware, data corruption, sabotage, denial of service, and identity theft (Kurbalija, 2016). Further, cybercriminals have graduated to using botnets, targeting cloud storage, and using the internet of things (IoT) to carry out large-scale attacks. This makes it problematic and costly for enforcement officers to identify the offenders, collect evidence, and prosecute the direct offenders (Kreimer, 2006). Consequently, governments have changed tactics, shifting from only going after direct offenders to imposing liability on intermediaries and further enlisting them to net the direct offenders.

This article adopts the description of intermediaries offered by Perset (2010) and MacKinnon (2015), whereby intermediaries are entities which: (1) give access to, host, transmit, and index content, products and services originated by third parties on the internet, or (2) provide internet-based services to third parties. This definition includes internet service providers (ISPs), data-processing and web-hosting providers, internet search engines and portals, e-commerce platforms, social networks, online communities, and blogging services (MacKinnon, 2015, p. 21). It is possible to delineate the extent of liability imposed on intermediaries into three categories: strict liability, conditional liability, and broad immunity (MacKinnon, 2015, p. 40). Different modes of liability are levied for different offences. These modes also differ according to the jurisdiction.

5. How the 2018 Act addresses intermediary liability

Strict intermediary liability is imposed when the mere fact of providing access to illegal content incriminates the intermediary. Section 24 of the Act, which creates the offence of child pornography, hints at strict liability, but, as discussed below, this may be in conflict with section 56, which gives an overarching direction on intermediary liability.

It is opined that strict liability inevitably leads to excessive monitoring and censorship by intermediaries (Hornik & Villa llera, 2017). Intermediaries are likely to refuse to carry content that closely resembles forbidden categories, even where the illegality is debatable. This poses a risk to freedom of expression. For an intermediary to escape liability under the strict-liability principle, it has to proactively monitor all the content accessible to users in a certain jurisdiction, distinguish between legal, illegal and questionable conduct, constantly filter the content, and disrupt the activities likely to give rise to liability for the intermediary in that jurisdiction. The reverse may also be true, unfortunately: Failure to impose strict liability may act as a disincentive to proactive monitoring on the part of the intermediary.

Conditional liability

Under a conditional-liability regime, intermediaries are exempt from liability if they abide by certain conditions laid out in law. This liability regime is an extrapolation of the tortious principle of vicarious liability (Sloot, 2015). Under vicarious liability, an intermediary would be held accountable if it had knowledge of any illegal activity carried out using its resources, had the ability to exercise control to stop the illegal activity, and stood to benefit in one way or another from the illegal activity. Conditional liability is the foundation of the celebrated "safe harbours" protection. (A "safe harbour" protection exempts an intermediary from liability if the intermediary abides by certain rules.) This seems to be the approach taken by section 56 of the Act, which gives the conditions that would give rise to civil and criminal intermediary liability. We note, however, that section 56 is not specific enough on what these

conditions are. This is likely to present difficulties for law enforcement and for the courts when inferring intermediary liability.

The third category of intermediary liability cited above, broad immunity, accords the intermediaries the protection under conditional liability and goes a step further, allowing them to come up with a content policy. If the intermediaries disrupt activities based on this content policy, they are protected from liability. For instance, pulling down content violating their content policy will not be termed a violation of their users' freedom of expression. Broad immunity is not adapted in the Act.

Section 56 of the Act provides a general statement on intermediary liability. An intermediary will attract civil or criminal liability if it had actual notice or actual knowledge of an offence, or if the intermediary wilfully and with malicious intent facilitated the commission of the offence. If by a mere omission or failure to act the intermediary facilitated, aided or abetted the commission of the offence, no liability will attach. It is unclear from the Section at what point actual notice and knowledge become a determining factor for liability. For instance, if an intermediary learns of an offence *ex post facto*, does this count as actual knowledge for which the intermediary will be liable? The section also fails to offer an absolution route for the intermediary. Should the intermediary learn of an impending offence over which it has no control, what should the intermediary do to excuse itself from liability? Further, where an intermediary has been made aware of unlawful content and fails to take action to disrupt access, does this constitute knowledge and wilful action for purposes of subsequent prosecution?

Section 56(2) absolves intermediaries from liability for maintaining and making available the provision of their service. This override comes close to the renowned safe harbours which are a list of the core functions of intermediaries that would be exempted from liability. Without such a wholesale exemption from liability, criminal liability may be imposed on a case-to-case basis, usually by arbiters who may not appreciate the intricacies and roles of each internet intermediary.

Reading sections 56(1) and (2) together leads to the conclusion that the Kenyan position is that intermediaries will not be held responsible for any unlawful conduct unless it can be shown they had actual notice or actual knowledge of the conduct or that they acted wilfully and with malicious intent to facilitate the unlawful conduct. There are several other sections in the Act that tease intermediary liability without stating as much. One such section is section 42, which makes it an offence to knowingly and wilfully aid or abet the commission of any offence under the Act. The *men rea* elements of this offence are "knowledge" and "wilful action", just as in section 56.

Notice and knowledge

What amounts to actual "notice" and actual "knowledge" is a controversial issue in itself. It is often argued that intermediaries have knowledge and control of, or have the ability to monitor, the content they provide access to (Article 19, 2013). Such a stance fails to take into account the fact that it is economically and technically infeasible for intermediaries to monitor all the activity taking place over the internet (Truyens & Van Eecke, 2016). Further, such large-scale monitoring of, and blocking of access to, content may lead to a "chilling effect", whereby intermediaries, afraid of the consequences of non-compliance or that their conduct will lead to unforetold liability, may resort to broad censorship and blocking and in the process disrupt access to lawful content (Truyens & Van Eecke, 2016, p. 6).

The other issue pertaining to knowledge and notice is the matter of what precisely amounts to knowledge by the intermediary. Courts would have to contend with whether knowledge by any personnel at the intermediary is enough to implicate the intermediary, or whether there is a designated officer of the intermediary who must have had knowledge for liability to attach.

Publication

Two other sections in the Act invoke intermediary liability: section 24 on child pornography and, by extension, sections 22 and 23 on false publications. What is problematic in section 24 is its definition of publication to include "making available in any way". Sections 22 and 23, meanwhile, use the word "publish" but fail to define the parameters of the word in the context of those two sections. Following the principles of statutory interpretation, it is possible that the courts will look to section 24 to define publication under sections 22 and 23. Section 24 also extends criminal liability to entities that have, in their possession or custody, child pornography materials. Intermediaries offering cloud storage facilities may be netted under this section.

What these sections in the Act mean to search engines, in particular, needs further examination. Two aspects of search engines are of concern: caching and dissemination (Gürkaynak, 2013). Both of these functions are carried out in a technical, automatic, and passive manner. It would therefore be untenable to demand that search engines be obliged to consider the legality of a website that they make available in their search results. This would also be inconsistent with international judicial precedent on the legal liability of search engines.[11]

Nonetheless, it does not seem that search engines would escape liability under section 24. Whereas search engines are not publishers in the traditional sense,[12] it

11 See *SARL Publison System v SARL Google France*, Court of Appeal, Paris (19th March 2009); and *Jensen v Google Netherlands*, District Court of Amsterdam (26 April 2007).

12 See *Perfect 10 v. Google, Inc.*, 78 U.S.P.Q. 2d 1072 (C.D. Cal. 2006).

may be argued that they do indeed "make content available" which would make them publishers under section 24 of the Act. To avoid liability, a search engine would have to make sure that none of its ranked and listed links are to a site containing pornographic material as contemplated in section 24(3) of the Act. An alternative legislative approach that would achieve the same result without disproportionately burdening search engines would be to extend immunity to the search engines as long as they are unaware that a website whose link they have listed is illegal. This may be cured by section 56(2). How sections 24(1) and 56(2) co-exist will be a matter for judicial interpretation.

Critical information infrastructure

The Act establishes the National Computer and Cybercrimes Co-ordination Committee, which will be made up of public officers drawn from various government offices. The Committee will designate certain systems, deployed in the health, energy, financial and security sectors, as critical infrastructure (sect. 9). Designation as critical infrastructure comes with additional responsibilities to the intermediaries in charge of the systems. For one, these intermediaries will be subjected to an additional level of regulation by the Committee. Secondly, these intermediaries will be required to report any cybercrime threats to the system to the Committee. In addition, a compliance report is to be submitted to the Committee. Failure to comply with these requirements constitutes an offence.

Investigation procedures

Part IV of the Act addresses investigation procedures. Often, investigation procedures run afoul the right to privacy, which is guaranteed under Article 31 of the Kenyan Constitution. A lack of clear-cut procedures also subjects intermediaries to an unpredictable governance environment, which may sour customer relations and open up the intermediaries to lawsuits. What we see in Part IV is an added responsibility to intermediaries.

Section 48 outlines the search-and-seizure procedure, which involves getting a warrant from a court. A court may grant a warrant to search a premises once it is satisfied that there is a plausible reason that data therein would help in the investigation of a crime or was acquired criminally. This section fails to take into account that when it comes to digital evidence, the search warrant ought to take care of two things; the physical search of the premises to seize hardware that may have been instrumental in committing a crime and an electronic search to obtain data from the seized hardware (Kerr, 2005). A mere search on the premises does not give police officers the permission to obtain information located in computer hardware. A better approach would be to include in the preconditions for granting a warrant that the police officers ought to identify the evidence to be sought at both the physical and electronic search stages. The search warrant described in this section would also not be adequate where the evidence is stored in a cloud.

According to section 49(2), the owner of the seized system may be allowed some leeway to access and copy the information in the seized system. This is not guaranteed however as the police officers have the right to refuse access. This raises concerns for business operations. Investigations take time. Such a refusal would ground an entity and in fast paced sectors, render them redundant. Extended retention with no access also raises a constitutional issue as it affects the right to own property (in Article 40 of the Constitution).

Police officers will have the right, subject to judicial approval, to co-opt service providers in their investigations as per section 52(1)(b)(ii). This opens up intermediaries to corporate espionage. The Directorate of Criminal Investigations has a digital forensic lab with equipped forensic examiners. This is the office that ought to assist the police officers in investigations.

Intermediaries will not be liable for the disclosure of any information if the disclosure is made pursuant to the Act. Some of the orders compelling intermediaries to release certain information to police officers may be accompanied by a gag order. The gag order will require the intermediary to keep confidential the existence of any such orders and the extent of the intermediary's cooperation in the investigation. The relationship between intermediaries and their customers is one of trust. Full disclosure on what the intermediary has done to co-operate with the government would boost this trust. The 2001 Budapest Convention on Cybercrime, in its Article 16, proposes that details on the extent of the intermediaries' cooperation with the government be kept confidential but only for a certain period of time (Council of Europe, 2001). It is indeed necessary to keep this information confidential for a given period of time to protect the integrity of an investigation. Beyond that, intermediaries should be free to disclose to their customers that their information was shared with law enforcement.

Service providers

The Act imposes obligations on service providers. For purposes of the Act, a service provider is defined as "a public or private entity that provides to users of its services the means to communicate by use of a computer system and any other entity that processes or stores computer data on behalf of that entity or its users" (sect. 2). While the first part targets ISPs, the second part of the definition is wide enough to cover all internet intermediaries.

Intermediaries are required to cooperate with police officers to provide three types of data; subscriber information, traffic data and content data. These three requirements are considered in detail below.

In cooperating with law enforcement, intermediaries have to balance the need to protect the privacy of their customers who have trusted them with their personal information and communication vis-à-vis their role in the maintenance of law and

order (Kerr & Gilbert, 2004). On one hand, any cooperation efforts by intermediaries will inevitably affect the relationship between the intermediary and its customers. On the other hand, the criminal sanctions imposed for non-compliance do not allow the intermediaries any wiggle room. Legislation imposing such responsibilities on intermediaries must therefore be cognizant of this dynamic and have at its core the dedication to protect and uphold constitutional rights. If legislation does not adhere to the constitutional safeguards, and if intermediaries act according to such legislation, they become complicit in the violation of human rights as they are agents of the state in doing so.[13] They may also be liable for breach of contract and constitutional violations.

Subscriber information

Subscriber information is defined as information disclosing the identity, location and address of a subscriber together with their subscription details (sect. 2). This information is comparable to the details that would normally be available at a telephone directory hence is sensitive (Kerr & Gilbert, 2004). In terms of the 2018 Act, intermediaries will only be required to release this information pursuant to a court order (sect. 50).

Section 50(1) contains a drafting error; as currently drafted, the section suggests that subscriber information may only be obtained for investigation purposes,[14] whereas any other information may be sought for whatever reason.[15] This section needs to be amended so that the rider "is necessary or desirable for purposes of an investigation" covers both section 50(1)(a) and (b).

Traffic data

Traffic data are defined, in section 2 of the Act, as information concerning the origin, destination, route, time, date, size and duration of communication and the type of underlying service. Normally, this would be information such as the sender and recipient of an email, the subject lines of the email and its size, the titles of any attachments, websites visited by a user, and the time spent at each website (Kerr & Gilbert, 2004). This is the footprint of a user's communication on the internet, hence more sensitive and worthy of stricter protection.

The Act anticipates expedited preservation of traffic data as well as real-time collection of traffic data. These are dealt with differently, as we explain below:

Expedited preservation and disclosure of traffic data

For the expedited option, a notice to preserve and disclose traffic data will originate from a police officer or an "authorised person" (sect. 51). The Act is not specific on

13 See *R v Weir* 3d 59 Alta. L.R., 319.
14 Section 50(1)(b).
15 Section 50(1)(a).

who an authorised person will be, or the person's qualifications, save for providing that this will be a person designated by the Cabinet Secretary. The expedited option may only be exercised where there is a risk that the traffic data may be modified, lost, destroyed, or rendered inaccessible. The notice may also require an intermediary to disclose traffic data that would be sufficient to identify the service providers and the path through which the communication was transmitted.

The data specified in the notice are to be preserved for a period not exceeding 30 days. This period may be extended by a court order once the person issuing the first notice shows that the extension is necessary for an ongoing investigation, there is a risk that the data will be lost, and that the cost of preservation of the data for an extended period of time is not overly burdensome (sect. 51(3)).

That a police officer can issue a notice to a service provider to preserve and disclose traffic data without obtaining a court order first is worrisome. Such a provision ignores the safeguards in Article 31(d) of the Constitution of Kenya which protects the privacy of communications. This right is not absolute. However, any limitation thereof has to be in line with Article 24 of the Constitution. Specifically, the extent of the limitation has to be specific. Allowing police officers to bypass judicial approval on the basis of "reasonable grounds" allows the violation of the right to privacy based on a vague and subjective test.

That the court can order the extension of this period to more than 30 days is also of concern. This means that for a period of 30 days or more, the intermediaries ought to preserve every piece of information a user inputs into the internet or downloads therefrom at the intermediary's own cost.

Police officers will also be able to use these orders to identify all the telecommunications providers involved in the transmission of the communication in question.

Real-time collection of traffic data

Real-time collection of data may be done by a police officer, an authorised person as described above or an intermediary. Such collection has to be pursuant to a court order. Intermediaries may collect and record traffic data then submit the same to the police officer. Alternatively, they are obliged to cooperate and assist the police officer to collect and record such information whether the information is transmitted through means owned by the intermediary or not (sect. 52).

Section 52(4) requires that a court order for real-time collection and recording of traffic data ought to allow for the collection to take place for a period not exceeding six months with the possibility of extension by a court order. This will be at the cost of the intermediary.

If an intermediary fails to comply with the obligations under section 52, they may be fined up to ten million Kenyan shillings. Further, a principal officer of the intermediary may be fined up to five million shillings, be imprisoned for up to three years, or be punished by both fine and imprisonment.

Real-time interception of traffic data is a gross violation of privacy. It provides a window into a person's life, revealing not only their particular movements, but also their familial, professional, religious and sexual association and preferences. This measure ought to be used sparingly and only for specified offences (Kerr & Gilbert, 2004).

Interception of content data

Content data have been defined in the Act as the substance, meaning, and purport of a specified communication (sect. 2). In other words, this is the actual text of messages, emails, publications, and search queries. As interception of such communication is a severe violation of the right to privacy, it must only be employed in very special cases.

In terms of the Act, a police officer or an authorised person may apply to the court for an order permitting the police officer or authorised person to collect or record content data in real time. The order may also compel an intermediary to either collect or record the content-data or to cooperate and assist the authorities. Such an order will only apply to specified communication and cannot be for a period exceeding nine months. However, this period may be extended (sect. 53).

Because of the provisions of the Act, it is apparent that intermediaries will have to restructure internally and set up mechanisms to distinguish between traffic data and content data. Instances of cybercrime are on the increase. This will inevitably translate to numerous court orders and notices to cooperate with police officers in the investigation of cybercrimes. It would be prudent for intermediaries operating in Kenya to carry out an audit on how much it will cost to execute the court orders and police notices issued under Part IV of the Act.

International cooperation

International cooperation has become an integral part of combating cybercrime given the transnational nature of crimes committed on or via the Internet (Mittal & Sharma, 2017). While the cyberspace has no borders, police officers have to respect the sovereignty of other countries by collaborating through international conventions or treaties (Mittal & Sharma, 2017, p. 1373). This presents challenges as to the jurisdiction of courts, trans-national investigation, and the use of extra-territorial evidence in cases where this does not exist. Kenya has in place the Mutual Legal Assistance Act, 2001 (Republic of Kenya, 2001). This Act allows Kenya to facilitate the interception of communication, preservation of communication data and covert electronic surveillance at the request of another State.

Part V of the Act is meant to complement the Mutual Legal Assistance Act. Section 58 of the 2018 Act allows the Central Authority created under the Mutual Legal Assistance Act to forward to a foreign state information obtained even where there has been no request for the same. If in the course of an investigation, it is discovered that a service provider in another state was involved in the transmission of communication, the Central Authority will be allowed to disclose the traffic data obtained under Part IV of the 2018 Act to that other state in order to identify the service provider and the path through which the communication was transmitted. With regard to requests to access stored computer data, real-time collection of traffic data, and interception of content data, the Central Authority will be required to obtain the necessary warrants and orders according to the prevailing laws at that time.

6. Constitutionality of the Act challenged

The Act was assented to law on 16 May 2018, and was to come into force on 30 May 2018. However, on 29 May 2018, the Bloggers Association of Kenya (BAKE) obtained court orders suspending the coming into force of the Act, until a petition challenging the constitutionality of the Act is heard and determined.

The challenge focuses on 26 sections in the Act. Part IV of the Act is being challenged. It deals with investigation procedures and requires service providers to provide police officers with subscriber information, traffic data, and content data. According to BAKE, the procedures outlined in Part IV do not meet the threshold prescribed under Article 24 of the Kenyan Constitution. Under the Constitution's Article 24, an Act limiting any fundamental right must clearly state to what extent a particular right is being limited. The limitation should not go so far as to derogate from the core of the right protected by the Constitution. It has been posited by BAKE that the procedure outlined in Part IV is cavalier in its treatment of the right to privacy.

Sections 22, 23 and 24 of the Act have also being challenged, on grounds of limiting the right to freedom of expression.

In our analysis, it is an opportune time for intermediaries with operations in Kenya to join the constitutional petition and challenge the definition of the word "publish", especially in section 24, in order to avert strict liability of intermediaries.

7. Conclusions and recommendations

The position proffered by the 2018 Act in section 56 is that intermediaries will not be liable for merely providing a service. Criminal liability will only be imposed if the intermediary had actual knowledge or notice, or if the intermediary acted out of wilful malicious intent. The foundation of such a statement on liability is noble, as it seeks to protect the internet infrastructure while punishing bad actors. However, the

test that is created is alarmingly subjective, leaving it to the courts to determine as and when liability will attach.

There are also other sections, such as sections 22, 23 and 24, which hint at intermediary liability and appear to be in conflict with the general statement on liability in section 56. These contradictions will be left to the courts for interpretation. Judicial discretion often causes uncertainty on the issue of intermediary liability, and is hence undesirable.

Where intermediaries would be hardest hit, however, is by the requirement for their cooperation in investigation procedures. The Act essentially converts intermediaries into state agents, with the added threat of criminal liability should they not offer their assistance as required. In addition, the Act potentially opens a floodgate of opportunities for law enforcement to turn to intermediaries for assistance, yet remains silent on the cost of such cooperation.

That constitutionality of the Act is now in challenge means that there is a possibility that some of the sections will be expunged from the Act should they be found to be non-conforming to the Constitution of Kenya. Any conclusion on intermediary liability in this article is therefore subject to the court's finding.

We now provide our recommendations for subsequent amendment of the Act.

Preliminary definitions

The following terms are used in the body of the Act but are never defined in the preliminary page: public security, public health, access, unauthorised, protected computer system, critical data/database, national information infrastructure, and illegal devices. It is proposed that, for the avoidance of ambiguity, appropriate definitions for the same are provided.

Content offences

Sections 22 and 23: False publications and publication of false information: These two sections prescribe offences in a manner that amounts to an unconstitutional limitation of freedom of expression. Failing to describe what activities amount to "publish" also puts intermediaries at risk.

- *Proposal 1: Publication of false information should only be an offence if it amounts to hate speech, propaganda for war or any of the exceptions listed in Article 33(2) and (3) of the Constitution.*
- *Proposal 2: Define what amounts to a publication. It is proposed that the offence be defined to only capture the source of the publication to avoid netting innocent internet users who only share the information.*

Section 24: Child pornography: The definition of "publish" in section 24 may be prejudicial to intermediaries as it introduces a strict liability regime despite the conditional liability position taken by section 56(2). The word "publish" includes "making available in any way". Further, intermediaries offering cloud storage solutions may be found guilty of possession of child pornography.

- *Proposal 1: Redefine the offence of child pornography. Specifically remove the definition of publish that denotes 'making available in any way'.*
- *Proposal 2: The offence of possession of pornographic material should be restricted to primary offenders to protect intermediaries who offer cloud storage facilities.*
- *Proposal 3: Section 24 ought to be harmonised with Section 16 of the Sexual Offences Act, particularly with regard to the amount of fines payable and duration of sentences.*
- *Proposal 4: The lawful possession of child pornography should only be limited to law enforcement purposes. Even in this case, there should be clear provision for what the lawful management of child pornography in the course of law enforcement entails and by whom.*

Intermediary liability

Various sections in the Act touching on intermediary liability require harmonisation.

Section 56: Confidentiality and limitation of liability: Section 56(2) attempts to create a safe harbour for intermediaries. However, the general language used in the Act leaves room for manipulation. For instance, a bulletproof hosting service that offers "hacking-as-a-service" may rely on this section to avoid liability since availing a service exempts it from liability under section 56(2).

- *Proposal 1: Enumerate safe harbours for intermediaries based on function, e.g., conduits, caching, hosting and information location. Anything outside these harbours attracts liability.*

Section 56 also imposes liability on intermediaries in cases where there is actual knowledge and notice of an offence. Some aspects of this section need clarification.

- *Proposal 2: What constitutes adequate knowledge and notice needs to be defined. Proof of knowledge and notice must also be determinable. For instance, the Act could impose a duty on intermediaries to designate a reporting officer. Once a complaint is sent to the reporting officer, this amounts to actual knowledge and notice.*
- *Proposal 3: Enumerate what an intermediary is to do once it is notified of an offence, e.g., disable access or discontinue service, report to the authorities or send a cease notice. Failure to take any such action is what ought to constitute an offence, not mere knowledge.*

The approach taken by the Act is to impose criminal liability to secure co-operation by intermediaries. The threat of criminal responsibility on the intermediaries themselves may lead to overzealous censorship.

- *Proposal 4: We propose a change of approach from conditional liability to broad immunity. The Act could set out a requirement for intermediaries to come up with content policies on areas such as child pornography and hate speech. These policies ought to meet a certain threshold. Failure to abide by these policies must lead to loss of service. The intermediary should be further protected from liability for discontinuing service based on their internal policy. This approach would achieve intermediary co-operation without the unnecessary hostility.*

Investigation procedures

Sections 47-56: These sections provide for investigation procedures including search and seizure of stored computer data, record of and access to seized data, production order and grounds for such application of a production order by a police officer, expedited preservation and partial disclosure of traffic data, the period for such preservation and extension of the said period. These sections have the highest impact on Intermediaries and we propose the following as mitigating measures.

- *Proposal 1: Warrants for obtaining digital evidence should be approached differently from traditional warrants. To obtain them, a police officer must not only be able to identify the premises to be searched but also the computer system to be searched. The wording of the warrants should reflect realities in the digital age e.g. cloud storage.*
- *Proposal 2: Where computer systems are seized as part of an investigation, they should be returned within a specified period of time. This will not only encourage speed on the part of police officers but will also ease the burden on the owner of systems.*
- *Proposal 3: The owner of a computer system must be allowed to access a seized system and copy it to avoid jeopardizing their trade.*
- *Proposal 4: The circumstances that warrant a police notice to record and disclose traffic data without a court order must be specifically and explicitly defined by legislation to avoid abuse of power.*
- *Proposal 5: Investigation should be restricted to police officers and authorised government agencies and experts. Co-opting private industry players as state agents is open to abuse, particularly if the co-opted investigator is from a rival company and able to exploit intellectual property encountered during investigations.*
- *Proposal 6: The requirement that intermediaries cannot disclose details of any warrant or production order should be time bound. Once the investigation is complete, intermediaries should be given the option to disclose the level of their co-operation to their respective clients. This enhances the client-intermediary trust relationships and is in line with international best practice.*
- *Proposal 7: Expedited preservation of traffic data should be court ordered. Leaving this to the police officers may lead to a multiplicity of notices, which may translate to higher costs on the part of the intermediary.*
- *Proposal 8: Real-time collection of traffic data should be reserved for specific offences or circumstances.*

- *Proposal 9: The cost of monitoring, collecting, preserving and producing data should be borne by the State and not by the intermediaries.*
- *Proposal 10: Section 50 should be amended to include the rider 'is necessary or desirable for purposes of an investigation'. This would qualify and cover the intentions of both sections 50(1)(a) and (b).*

References

Article 19. (2013). *Internet intermediaries: Dilemma of liability*. Retrieved from https://www.article19.org/wp-content/uploads/2018/02/Intermediaries_ENGLISH.pdf

Best, M. L. (2004). Can the internet be a human right? *Human Rights & Human Welfare, 4*(1), 22–31.

Business Daily. (2018, April 6). Two men charged with hacking into Safaricom system. Retrieved from https://www.businessdailyafrica.com/corporate/Two-men-charged-with-hacking-Safaricom-system/539550-3880240-140vv0az/index.html

Cheeseman, N. (2008). The Kenyan elections of 2007: An introduction. *Journal of Eastern African Studies*, *2*(2), 166–184. https://doi.org/10.1080/17531050802058286

Communications Authority of Kenya (CAK). (2017). *First quarter sector statistics report for the financial year 2017/2018 (July-September 2017)*. Retrieved from http://www.ca.go.ke/index.php/statistics

Council of Europe (2001). Convention on Cybercrime (Budapest Convention).

Dinwoodie, G. B. (Ed.). (2017). *Secondary liability of internet service providers*. Springer. https://doi.org/10.1007/978-3-319-55030-5

Englander, E., Donnerstein, E., Kowalski, R., Lin, C. A., & Parti, K. (2017). Defining cyberbullying. *Pediatrics, 140(Supplement 2)*, S148–S151. doi:10.1542/peds.2016-1758u

George Andare v the Attorney General & 2 Others [2016] eKLR, High Court of Kenya.

Gürkaynak, G., Yılmaz, İ., & Durlu, D. (2013). Understanding search engines: A legal perspective on liability in the Internet law vista. *Computer Law & Security Review, 29*(1), 40–47. https://doi.org/10.1016/j.clsr.2012.11.009

Hornik, J., & Villa llera, C. (2017). *An economic analysis of liability of hosting services: Uncertainty and incentives online*. Bruges European Economic Research Papers 37/2017.

International Telecommunication Union (ITU). (2017) *Global cybersecurity index.* Geneva.

Kerr, I. R., & Gilbert, D., (2004). The role of ISPs in the investigation of cybercrime. In T. Mendina, & J. L. Britz (Eds.) (2004), *Information ethics in an electronic age: Current issues in Africa and the world* (pp. 163–172). Jefferson, NC: McFarland and Company.

Kerr, O. S. (2005). Search warrants in an era of digital evidence. *Mississippi Law Journal, 75*(1), 85–145.

Kreimer, S. F. (2006). Censorship by proxy: The First Amendment, internet intermediaries, and the problem of the weakest link. *University of Pennsylvania Law Review, 155*(1), 11–101. https://doi.org/10.2307/40041302

Kurbalija, J. (2016). *An introduction to internet governance*. Switzerland: Diplo Foundation.

MacKinnon, R., Hickok, E., Bar, A., & Lim, H. I. (2015). *Fostering freedom online: The role of internet intermediaries*. Paris: UNESCO.

Mittal, I. P. S., & Sharma, P. (2017). A review of international legal framework to combat cybercrime. *International Journal of Advanced Research in Computer Science*, *8*(5), 1372–1374. https://doi.org/10.2139/ssrn.2978744

Ndemo, B., & Weiss, T. (Eds.) (2016). *Digital Kenya: An entrepreneurial revolution in the making*. Springer.

Perset, K. (2010). *The economic and social role of internet intermediaries.* Paris: OECD. https://doi.org/10.1787/5kmh79zzs8vb-en

Rainie, L., Kiesler, S., Kang, R., Madden, M., Duggan, M., Brown, S., & Dabbish, L. (2013). *Anonymity, privacy, and security online*. Washington, DC: Pew Research Center.

Republic of Kenya. (1963). Evidence Act, 1963.

Republic of Kenya. (1998a). Kenya Communications Act, 1998.

Republic of Kenya. (1998b). Kenya Information and Communications Act (KICA), 1998.

Republic of Kenya. (2001). Mutual Legal Assistance Act, 2001.

Republic of Kenya. (2006). Sexual Offences Act, 2006.

Republic of Kenya. (2008a). Kenya Information and Communications Act, 2008. Retrieved from http://www.ca.go.ke/index.php/sector-legislation

Republic of Kenya. (2008b). National Cohesion and Integration Act, 2008. Retrieved from http://www.kenyalaw.org/lex/actview.xql?actid=No.%2012%20of%202008

Republic of Kenya. (2010). Constitution of Kenya, 2010. Retrieved from http://kenyalaw.org/kl/index.php?id=398

Republic of Kenya. (2013). Kenya Information and Communications (Amendment) Act, 2013. Retrieved from http://www.ca.go.ke/index.php/sector-legislation

Republic of Kenya. (2018). Computer Misuse and Cybercrimes Act, 2018. Retrieved from http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/ComputerMisuseandCybercrimesActNo5of2018.pdf

Serianu, K. (2017). *Cybersecurity report 2017: Demystifying Africa's cyber security poverty line.* Retrieved from http://www.serianu.com/resources.html

Sloot, B. (2015). Welcome to the jungle: The liability of internet intermediaries for privacy violations in Europe. *J. Intell. Prop. Info. Tech. & Elec. Com. L.*, *6*(3), 211–228.

Technology Coalition. (2015). *Employee resilience guidebook for handling sexual exploitation images*. Retrieved from http://www.technologycoalition.org/wp-content/uploads/2015/01/TechnologyCoalitionEmployeeResilienceGuidebookV2January2015.pdf

Truyens, M., & Van Eecke, P. (2016). Liability of domain name registries: Don't shoot the messenger. *Computer Law & Security Review, 32*(2), 327–344. https://doi.org/10.1016/j.clsr.2015.12.018

Challenges, Benefits, and Adoption Dynamics of Mobile Banking at the Base of the Pyramid (BOP) in Africa: A Systematic Review

Richard Pankomera
PhD Candidate, School of Information and Communication Technology, Nelson Mandela University, Port Elizabeth, South Africa; and Lecturer, Mzuzu University, Malawi

Darelle van Greunen
Professor, School of Information and Communication Technology; and Director, Centre for Community Technologies, Nelson Mandela University, Port Elizabeth, South Africa

Abstract
Increased mobile penetration in Africa offers great potential to accelerate financial inclusion through increased adoption of mobile banking by people at the base of the pyramid (BOP) on the continent. This article provides results from a systematic review of existing research findings on the challenges, benefits and adoption dynamics of mobile banking at the BOP in Africa. The systematic review, which followed PRISMA (preferred reporting items for systematic reviews and meta-analyses) guidelines, identifies the following key challenges for mobile banking diffusion at the BOP on the continent: poor mobile connectivity; lack of awareness of mobile banking services; illiteracy; poverty; lack of trust due to perceived security risks; legal and regulatory frameworks; and cultural factors. Based on analysis of these challenges, and of the benefits and adoption dynamics also identified, the article provides recommendations on how mobile banking services can be more sustainably implemented for the benefit of people at the BOP in Africa.

Keywords
mobile banking, financial inclusion, base of the pyramid (BOP), Africa; PRISMA (preferred reporting items for systematic reviews and meta-analyses), challenges, benefits, adoption dynamics, technology acceptance model (TAM), unified theory of acceptance and use of technology (UTAUT)

DOI: https://doi.org/10.23962/10539/26113

Recommended citation
Pankomera, R., & Van Greunen, D. (2018). Challenges, benefits, and adoption dynamics of mobile banking at the base of the pyramid (BOP) in Africa: A systematic review. *The African Journal of Information and Communication (AJIC), 21,* 21–49.
https://doi.org/10.23962/10539/26113

This article is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence: http://creativecommons.org/licenses/by/4.0

1. Introduction

The rapid spread of mobile devices has engendered a proliferation of mobile banking services throughout the world, with particular significance in African and other developing-world countries where the poorest members of the population have traditionally been unbanked, i.e., have not had a bank account. Accordingly, mobile telephony has contributed to a rise in financial inclusion for disadvantaged people in both developed and developing economies, including many African economies (Demirguc-Kunt, Klapper, Singer, Ansar, & Hess, 2018). Financial inclusion denotes delivery of financial services—e.g., savings, transactions, payments/transfers, credit, insurance, remittance services—at an affordable cost to disadvantaged and low-income groups (Kopala, 2010; World Bank, n.d.).

Globally, the percentage of adults who owned a formal bank account rose from 62% to 69% between 2014 and 2017. In the developing economies, the rise was from 54% to 63% (Demirguc-Kunt, Klapper, Singer, Ansar, & Hess, 2018). This shows that, starting from a lower base, more people are opening new bank accounts in developing than in developed countries—strong evidence of an increase in developing-world financial inclusion. However, in 2017, it was also estimated that 1.7 billion people in the world did not use formal financial services, and that more than 50% of adults in the poorest households remained unbanked (Demirguc-Kunt et al., 2018). This indicates that there is still great potential for increased financial inclusion in developing economies.

Most of the people who do not have formal bank accounts are at the base of the pyramid (BOP). According to BOP theory, there is a need to design and distribute affordable goods and services, including financial services targeting specifically the poor communities (Prahalad, 2006). According to the World Bank, 1 in 10 people in the world live under USD1.90, and therefore are considered as falling within the BOP category. Half of these extremely poor people live in Sub-Saharan Africa (The World Bank Group, 2018). Many business entities do not target people at the BOP, on the assumption that most products and services are not sufficiently profitable when delivered to poor communities, as the people in these communities tend not to be able to afford most products and services.

Rural communities in Africa have experienced a considerable proliferation of mobile devices for the past two decades. And Africa has the fastest growth rates in internet penetration, driven by mobile connectivity, with the number of internet users across the continent increasing by more than 20% in 2017 (Kemp, 2018). There were an estimated 362 million internet users in Africa in January 2017 (Kemp, 2017), and by 31 December 2017, only 12 months later, some estimates were putting the African total at 453 million internet users (World Internet Stats, 2018). West Africa had over 175 million unique subscribers (GSMA, 2018c) while the Middle East and North Africa had over 365 million unique mobile users (GSMA, 2018d) by 2017.

But in Sub-Saharan Africa, it is estimated that only 44% of the population had a mobile subscription at the end of 2017 (GSMA, 2018b) and it can be safely assumed that many of the approximately 56% of Sub-Saharan Africans without mobile subscriptions are living at the BOP.

The main research question for this systematic review was:

- What are the challenges, benefits and adoption dynamics of mobile banking for the people at the BOP in Africa?

Flowing from the research question, the following were the research objectives:

- to identify challenges hindering adoption of mobile banking by people at the BOP in Africa;
- to identify perceived benefits of mobile banking among people at the BOP in Africa; and
- to identify mobile banking adoption dynamics for people at the BOP in Africa.

For the purpose of this research, mobile banking was defined as the use of mobile devices to access bank accounts in order to conduct financial transactions such as verifying account status/balances, money transfer, bill payments (Alafeef, Singh, & Ahmad, 2012; Lee & Chung, 2009; Shih, Hung, & Lin, 2010). Examples of mobile banking services are (Mallat, Rossi, & Tuunainen, 2004; Porteous, 2006):

- accessing account information such as account balances;
- performing bank account transactions, such as funds transfers between accounts and third-party payments;
- accessing support services such as cheque or card requests; and
- accessing content services such as loyalty-related programmes

The next section provides context in terms of mobile adoption, and mobile banking adoption, in Africa. Section 3 discusses technology adoption theoretical models and mobile banking models, and section 4 outlines our application of the systematic review methodology. Section 5 gives an overview of the studies identified by the systematic review; section 6 discusses and analyses the findings gleaned from the identified studies; and section 7 provides recommendations based on the findings. A conclusion is then provided in section 8.

2. Study context

Mobile adoption in Africa

GSMA (2018a) reports that the percentage of mobile connections compared to the total population in the Southern Africa, East Africa, West Africa and North Africa is at 147%, 61%, 89% and 106% respectively. This means that there are more connections than the number of people in the Southern Africa and Northern Africa. The percentage of unique mobile users to the total population in the Middle East

and North Africa is 60% (GSMA, 2018d), while in Sub-Saharan Africa it is 46% (GSMA, 2018c). The New 2018 Global Digital Suite reports that Africa experienced a growing number of internet users of 20% on yearly basis, due to increasingly affordable smart devices and mobile data bandwidth (Kemp, 2018). In addition, the amount of time spent by people online is steadily increasing. The number of social media users in Africa went up by 13% in the year 2017. In terms of the usage of social media, Facebook is still the most-used social media platform in Africa, followed by YouTube (GSMA Intelligence, 2018).

Steady increases in the usage of mobile applications is being supported by better connection speeds. In 2017, 60% of African mobile connections were classified as broadband (Kemp, 2018). The mobile broadband connectivity in Southern Africa and East Africa were recently pegged at 83% and 22% respectively (GSMA Intelligence, 2018). It must be noted here that much as broadband connectivity offers faster data speeds, mobile banking transactions do not require broadband connectivity, and some can also be done via mobile telephony platforms without internet access.

Although there is promising mobile penetration in Africa, the potential for the usage of mobile technology by rural and poor people at the BOP remains relatively untapped. GSMA estimates that, at the end of 2017, only 44% of people in Southern Africa had mobile subscriptions, compared to the 66% global average (GSMA, 2018b). And that percentage is only expected to rise to 50% by 2025 (GSMA, 2018b). Most people who remain unconnected are vulnerable groups such as women and youth living in rural communities (GSMA Intelligence, 2016), i.e., people living at the BOP. A 2016 GSMA report cited high costs of mobile connectivity, lack of relevant local content, and high digital illiteracy levels as barriers for mobile penetration in the rural areas of Africa (GSMA, 2016).

Mobile banking adoption in Africa

The widespread and increasing use of mobile devices in Africa creates expectations that mobile banking adoption can increasingly extend to people at the BOP. By 2017, 38% of the people in the sub Saharan Africa had a broad connection which consequently accelerates digital and financial inclusion (GSMA, 2018b). For instance, there were 135 live mobile money services in 39 countries in Sub-Saharan Africa delivering financial inclusion to the unbanked populations as of 2017 (GSMA, 2018b). It is envisaged that among the estimated 56% of people in Sub-Saharan Africa who still, at the end of 2017, did not have a unique mobile connection, will in the future become mobile users and be able to benefit from mobile banking technology. Besides mobile connectivity, bank account ownership is one of the factors that influences the adoption of mobile banking. For instance, in Zambia, 20% of account owners opened their first account to receive digital payments. This implies that ownership of an account is a motivation for embracing digital payment services (Demirguc-Kunt, Klapper, Singer, Ansar, & Hess, 2018). This is expected to enable people at the BOP

to increasingly access the financial services in the rural areas (Mbiti & Weil, 2011; Morawczynski, 2009).

The downsides of traditional banking are that it requires the customer's physical presence at the bank premises, and the presence of bank staff at the branch to engage with the customers and paperwork. It is therefore both time-consuming and manpower dependent (Beck & Cull, 2013; Chavan, 2013). Therefore, many benefits have been cited for the adoption of mobile banking. Mobile banking makes it easy for the bank account to be accessible at any time from any place in the world, without the account-holder physically visiting the bank branches. This is why mobile banking is also referred to as "branchless banking" (Ivatury & Mas, 2008).

3. Theoretical models for technology adoption, and mobile banking models

Several approaches are cited when studying adoption of technology. One approach, which can be useful when looking at adoption of mobile banking, is to determine the correlation between the adoption of technology and influencing variables such as gender, age, voluntariness of use, and experience (Im, Hong, & Kang, 2011). Two models that adopt this approach are:

- the technology acceptance model (TAM); and
- the unified theory of acceptance and use of technology (UTAUT)

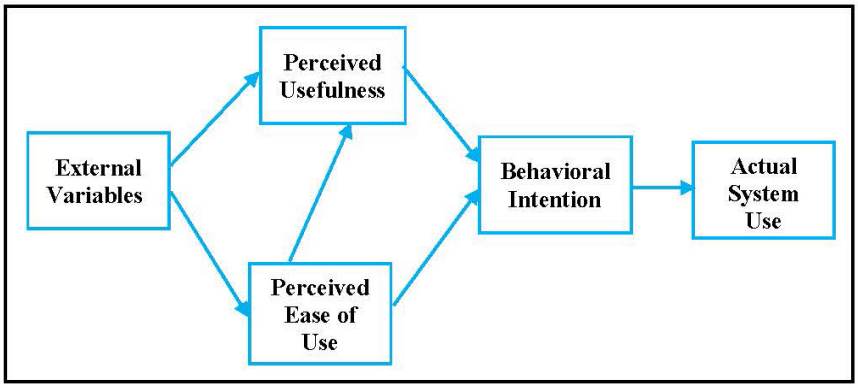
Other models that can be used in the analysis of adoption of mobile banking are:

- innovation diffusion theory (IDT);
- the information system success model (ISSM);
- the task technology fit (TTF) model; and
- the theory of planned behaviour (TPB).

Technology acceptance model (TAM)

There are various versions of TAM. The first version (TAM 1) posits that *perceived usefulness* and *perceived ease of use* influence users in respect of how and when they use a new technological offering such as mobile banking. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). A combination of perceived usefulness and perceived ease of use is, in turn, expected to influence *behavioural intention* to use and *actual system use*. Figure 1 illustrates TAM 1, in its final version as set out by Venkatesh and Davis (1996).

Figure 1: TAM 1, as set out by Venkatesh and Davis (1996)



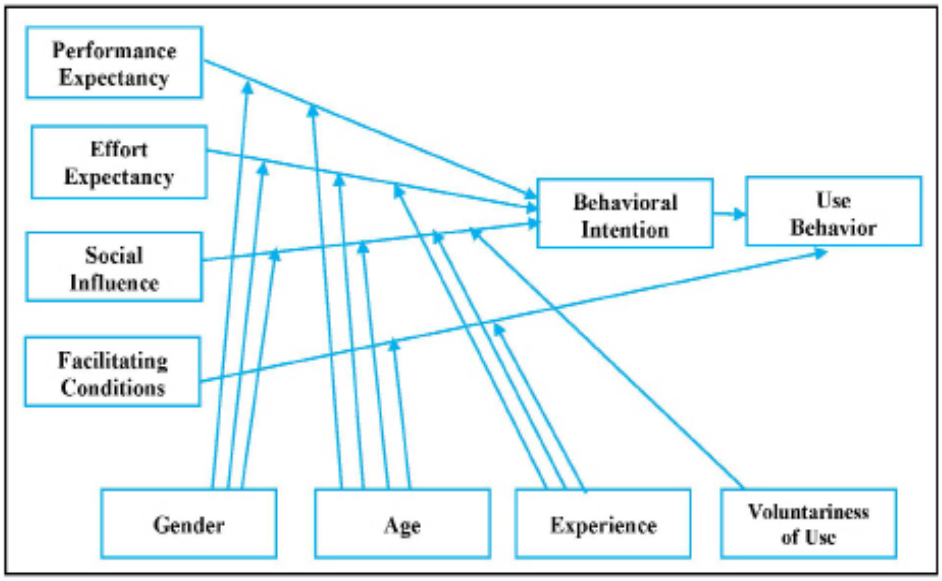
Source : Venkatesh and Davis (1996, p. 453)

TAM 2 introduced additional variables, such as relevance of job, quality of output, demonstrability of the output, image, subjective norm, voluntariness and experience of the user (Venkatesh, 2000). TAM 3 added even more variables: i) Anchor attributes such as computer self-efficacy, perception of external control, computer anxiety and computer playfulness and ii) Adjustments attributes such as perceived enjoyment and objective usability (Venkatesh & Bala, 2008). By integrating with other constructs, TAM has been used to assess the adoption of mobile banking in real world environment (Gu, Lee, & Suh, 2009; Rammile & Nel, 2012; Tobbin, 2012).

Unified theory of acceptance and use of technology (UTAUT)

UTAUT draws on other models, including TAM and TPB. UTAUT attempts to explain the degree of acceptance of the use of technology with respect to four predictors that may influence users' behaviour and intention: (1) performance expectancy; (2) effort expectancy; (3) social influence; and (4) facilitating conditions. In addition, gender, age, experience, and voluntariness are positioned as influencing the four aforementioned constructs in respect of users' behavioural intention (Venkatesh, Morris, Davis, & Davis, 2003). Figure 2 below illustrates UTAUT as it is proposed Vankatesh et al. (2003). Many researchers have used UTAUT to determine the factors that influence the adoption of mobile banking (Oliveira, Faria, Thomas, & Popovič, 2014; Yu, 2012).

Figure 2: UTAUT, as set out by Venkatesh et al. (2003)



Source: Venkatesh, Morris, Davis and Davis (2003, p. 447)

Innovation diffusion theory (IDT)

IDT endeavours to explain how, why, and at what rate, innovative new ideas and technology spread (Rogers, 1995). According to IDT, the four main elements that influence the spread of new ideas are: the innovation; communication channels; time; and a social system (Rogers, 1995). In addition, Rogers (1995) argues that there are five categories of adopters, namely: innovators, early adopters, early majority, late majority, and laggards. IDT builds upon Moore and Benbasat (1991) with the following additional characteristics of innovation: relative advantage, ease of use, image, visibility, compatibility, results demonstrability, and voluntary of use. In this case, demonstrability is defined as "tangibility of the results of using the innovation including their observability and communicability" (Moore & Benbasat, 1991, p. 203). A number of studies have used IDT constructs to interrogate diffusion of mobile banking in developing countries (Brown, Cajee, Davies, & Stroebel, 2003).

Information system success model (ISSM)

The ISSM is a model that is used to determine the success of a system based on the following: information quality, system quality, service quality, system use/usage intentions, user satisfaction, and net system benefits. The actual net benefit of the system and user satisfaction are understood as influencing a user's intentions to use a particular system (Delone & McLean, 2003). ISSM has been used to assess the impact on mobile banking on the livelihood of people (Lee & Chung, 2009).

Task technology fit (TTF)

The TTF model is based on the assumption that there is likely to be a positive impact on individual performance if the capabilities of the technology used match the tasks that the user must perform (Goodhue & Thompson, 1995). TTF has been widely used to assess success factors and impacts of mobile business applications (Gebauer & Shaw, 2004; Zhou, Lu, & Wang, 2010).

Theory of planned behaviour (TPB)

The TPB states that attitude towards behaviour, subjective norms, and perceived behavioural control all influence an individual's intentions and behaviours (Ajzen, 1985). A number of studies have been conducted that adopt the TPB approach to user behaviour in respect of mobile banking (Nasri & Charfeddine, 2012; Shih & Fang, 2004).

Mobile banking models

(Porteous, 2006) outlines the following four mobile banking models being followed in Africa:

- *Pure bank-driven model:* In this model, the bank has exclusive control of the deposit account. Therefore, the bank sells its own brand. Additional financial services may be extended to those who hold bank accounts by introducing mobile banking services. This is also called the "additive banking" model as it targets existing bank customers by providing them with better and more convenient banking services through channels such as ATMs and telephone-banking.
- *Joint-venture model:* The bank still holds ownership of the deposit account, but it goes into partnership with non-bank organisations, e.g., mobile network operators and/or other telecommunications company. Cash can still be accessed at the bank, but the bank can instruct the third party to carry out other payment transactions to the client.
- *Non-bank-led model:* The bank still takes control of the account, but the brand of a non-bank company (e.g., a mobile network operator or other telecommunications company) becomes dominant. Cash can still be accessed at the bank and any alternative network agent.
- *Non-bank-driven model:* Unlike the above-listed models, the non-bank-driven model allows non-bank companies (e.g., mobile network operators or other telecommunications companies) to own deposit accounts. The non-bank company can provide a range of financial services to the account-holder, including dispensing cash, and they can promote their own m-banking brands.

4. Research outline: The systematic review

The systematic review was guided by the PRISMA (preferred reporting items for systematic reviews and meta-analyses) framework and used research bibliographic databases such as Scopus and IEEE Xplore. The following were the guiding elements of the review, in line with the PRISMA model (Moher, Liberati, Tetzlaff, & Altman, 2009):

- inclusion criteria;
- search strategy;
- data collection and extraction;
- assessment of quality; and
- analysis.

Inclusion criteria

It was determined that the studies considered for inclusion would be from the period 2007 to 2018 and would include literature focused on mobile banking for individuals at the BOP in Africa.

Search strategy

Published reports, grey literature, peer-reviewed papers, and peer-reviewed journal articles on mobile banking were analysed. Peer-reviewed journal articles were searched in research databases including Scopus, EBSCOhost, and IEEE Xplore. These items identified were narrowed down to those that focused on the challenges and benefits of embracing mobile banking in Africa.

Keywords used to identify studies were: "mobile banking", "cell phone banking", "branchless banking", "BOP", "bottom of pyramid", "base of pyramid", "Africa", "developing countries", "poor economies" and "m-banking". Search keyword connectors such as AND, OR and NOT were used either to narrow or broaden the results.

Data collection and extraction

The14 studies that were retrieved in line with the inclusion criteria, and the data extracted from the studies, are featured later in this article in sections 5 and 6.

Assessment of quality

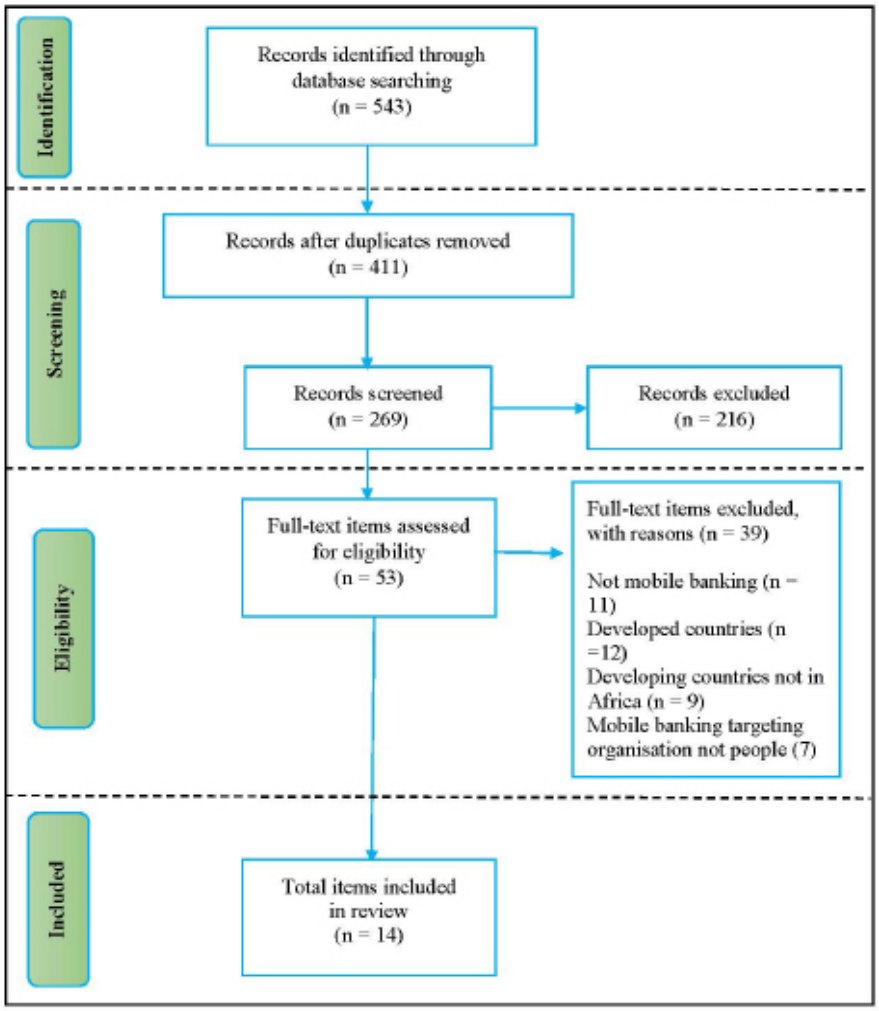
The data gathered in the previous steps were checked and verified by an independent researcher experienced in both qualitative and quantitative research. This process ensured the credibility of studies selected and ensured that the selected studies met the inclusion criteria.

Analysis

Figure 3 depicts the sequence of steps followed in the systematic review process. The titles and abstracts of the studies that met the criteria were scrutinised. Duplicates

were subsequently excluded, generating a total of 53 studies. Of those, 39 were excluded on the grounds that: some did not specifically focus on mobile banking; some only focused on mobile banking activities in developed countries; some looked at mobile banking in developing countries but not in Africa; some looked at mobile banking interventions that were not specifically targeting people at the BOP in Africa. Finally, 14 studies were identified for review.

Figure 3: PRISMA systematic review flowchart for the study



Source: based on flowchart in Moher, Liberati, Tetzlaff, and Altman (2009)

5. Studies selected via the systematic review

Study countries, regions

Twelve of the studies, collectively, look at mobile banking several individual countries—Nigeria, Zimbabwe, Sudan, Rwanda, South Africa, Malawi, Ghana, Zambia, Kenya, Mozambique—and two of the studies take a much broader approach, looking at mobile banking in Sub-Saharan Africa, and almost all of Africa (49 African countries), respectively.

Studies' foci

Eleven of the 14 studies focus on at least three of the following mobile-banking user dimensions: age group, gender, income level, education level, residence area, ownership of mobile device, experience of mobile device usage, perceived benefit, perceived ease of use of mobile banking, perceived usefulness of mobile banking, and social and cultural aspects of using mobile banking.

Studies' methods

Across the studies selected, both quantitative and qualitative methods are employed. Four studies use only quantitative methods, and three used only qualitative methods. The other seven studies use a mix of quantitative and qualitative methods. Many of the studies use survey questionnaires, and semi-structured face-to-face interviews, focus groups, and telephone interviews are also frequently used. Some studies make use of data sets from the International Telecommunication Union (ITU) and Global Information Society Watch.

Table 1, provided over the next three pages (pp. 32-34), presents an overview of the 14 studies from which data were obtained and analysed.

Table 1: The 14 selected studies

Author(s) (year): Country(ies), region	Objective(s), research question(s)	Theories, models	Data collection
Chukwumah (2017): Nigeria	• What factors influence adoption of mobile banking in rural Nigeria?	• TAM	• 186 questionnaire respondents in four villages in Katsina • Respondents' gender: M (44%), F (56%) • Ages: 84% between 20 and 49, 37% between 30 and 39 • Education: 33% with only primary school • Occupations: retailers (52%), farmers (20%) • Monthly income: 53% less than 5,000 Naira (36.5 USD) • Mobile phone ownership: 59% • More than three years of use of using mobile phone 26%
Mago and Chitokwindo (2014): Zimbabwe	• To evaluate the impact of mobile banking as a financial inclusion strategy	• Joint-venture model of mobile banking	• 270 survey respondents in Chivi, Bikita, Gutu and Masvingo • Income level data collected to determine possible influence on adoption of mobile banking
Ammar and Ahmed (2016): Sudan	• To examine the factors that influence adoption of mobile banking in the microfinance sector in Sudan	• UTAUT and technology organisation-environment (TOE)	• 393 survey respondents • Respondents' gender: M (43%), F (57%) • Age: 35% aged 28-37 • Education: 91% literate • Mobile phone ownership: 99% • Frequency of mobile usage: 85% daily • Duration of mobile experience: 61% with 6-8 years of experience
Van der Wansem (2013): Rwanda	• To research how mobile banking has affected financial inclusion, in terms of access and usage of financial services, with a distinction between rural and urban areas	• Pure bank-driven model of mobile banking	• 240 respondents to telephone survey • 5 focus groups from 5 locations: Kigali-East (7 participants), Kigali-West (17 participants), Musanza (15 participants), Cyanika (20 participants) and Ruhuha (12 participants)

Author(s) (year): Country(ies), region	Objective(s), research question(s)	Theories, models	Data collection
Bankole and Cloete (2011): South Africa, Nigeria	• To examine differences and similarities between mobile banking usage in South Africa and Nigeria	• UTAUT	• 451 questionnaire respondents: in South Africa (220) and Nigeria (231) • 10 face-to-face interviews each in South Africa and Nigeria respectively (6 males and 4 females interviewed from each country)
Mtambalika, Manda, Gombachika and Kunyenje (2016): Malawi	• To examine readiness of the bank-led "branchless banking" mobile banking model for outreach to unbanked rural areas in Malawi	• Pure-bank-driven model • TAM	• 210 completed questionnaires in 5 Traditional Authorities—Msundwe, Kalolo, Mduwa, Mavwere and Mlonyeni—in Lilongwe and Mchinji districts
Hinson (2011): Ghana, Africa	• To conceptualise a mobile banking model for the poor in developing-economy contexts	• Joint-venture model of mobile banking	• Literature review on mobile baking for the poor in Ghana and Africa
Tchouassi (2012): 30 Sub-Saharan African countries	• To identify effects of mobile phones on the rate of banking adoption	• Contestable market theory	• Data from ITU, and from reports by Global Information Society Watch, on 30 Sub-Saharan African countries • Independent variables: income, age group, urban or rural area
Van der Boor, Oliveira and Veloso (2014): Zambia, Kenya	• To examine factors that enable innovation in mobile banking services in developing countries	• Not specified	• Historical analysis of company reports, news articles, case studies, documents by vendors, on mobile banking • Interviews with industry leaders and researchers on mobile banking
Shrivastava (2010): South Africa	• To test attitudes towards mobile financial services, including mobile banking	• TAM	• 400 questionnaire respondents • Respondents' ages: 42% aged 25-34

Author(s) (year): Country(ies), region	Objective(s), research question(s)	Theories, models	Data collection
Asongu (2018): 49 African countries	• To investigate determinants of mobile banking adoption in 49 Sub-Saharan African countries	• Principal component analysis	• Data on variables—macroeconomic, business/bank, market-related, knowledge economy, external flows and human development—collected to investigate determinants of mobile phone/banking in 49 Sub-Saharan African countries
Van Deventer, De Klerk and Bevan-Dye (2017): South Africa	• To study the influence of perceived integrity of banks, and perceived system quality of mobile banking, among Generation Y students in the South African context	• Not specified	• 334 questionnaire respondents • Respondents' gender: M (42%), F (58%)
Mlitwa and Tshetsha (2012): South Africa	• To explore the understanding of mobile banking by rural communities in South Africa	• Not specified	• Interviews with 10 men and 10 women in Gugulethu and Nyanga townships, greater Cape Town, Western Cape Province
Baptista and Oliveira (2015): Mozambique	• To determine the impact of cultural moderators on behavioural intention to adopt mobile banking	• UTAUT 2	• 252 questionnaire respondents

6. Findings and analysis: Challenges, benefits, and adoption dynamics

Challenges

Poor mobile connectivity

Findings from six of the studies—examining conditions in Nigeria, Zimbabwe, Sudan, Rwanda, Ghana and South Africa—cite poor network infrastructure as the predominant barrier to people at the BOP embracing mobile banking (Ammar & Ahmed, 2016; Asongu, 2018; Hinson, 2011; Mago & Chitokwindo, 2014; Mlitwa & Tshetsha, 2012; Shrivastava, 2010). Poor cellular network coverage in rural areas limits people's access to financial and banking services over the mobile devices. Mobile signals in rural areas often negatively affect the quality of communication when performing mobile banking transactions. This is due to the fact that cellular companies tend not to prioritise signal quality for people in the rural areas, as rural areas, because of their lower population densities and lower incomes, tend not to be as profitable as urban areas for mobile operators. As a result, many people in rural areas who live very far away from the cellular towers experience poor mobile signals.

Lack of awareness of mobile banking services

Six studies cite the lack of awareness as undermining mobile banking at the BOP (Ammar & Ahmed, 2016; Baptista & Oliveira, 2015; Chukwumah, 2017; Hinson, 2011; Mlitwa & Tshetsha, 2012; Van der Wansem, 2013). Awareness also has an influence on the number of people who own bank accounts. Lack of awareness of mobile banking services is the second major barrier in adopting mobile banking. People who are not aware enough of the interface design, navigation, and contents of mobile applications lack the confidence to use mobile banking services.

Illiteracy

Four studies—looking at Sudan, Nigeria, South Africa and Ghana—highlight the fact that high illiteracy levels are a barrier to utilising mobile banking services (Ammar & Ahmed, 2016; Bankole & Cloete, 2011; Hinson, 2011; Mlitwa & Tshetsha, 2012). Due to high illiteracy levels in many parts of Africa, particularly in rural areas, many people at the BOP are not able to fully understand and interpret mobile banking services. It was found that people who are literate more easily appreciate the notion of mobile banking and are more likely to be aware of at least basic mobile banking services.

Poverty

Poverty is a contributing factor, because lack of regular income makes it a challenge for people at the BOP to open an account. Some banks require a customer to have an initial deposit when opening an account, and then there are transaction costs incurred once the account is open (Chukwumah, 2017; Hinson, 2011; Mago & Chitokwindo, 2014; Tchouassi, 2012).

Lack of trust due to perceived security risks
Four studies cite lack of trust in mobile banking as a barrier to utilisation mobile banking services (Chukwumah, 2017; Mlitwa & Tshetsha, 2012; Tchouassi, 2012; van Deventer, de Klerk, & Bevan-Dye, 2017). A key reason for this lack of trust is the perception of risks associated with mobile banking, e.g., fear of security threats, such as fraud, that can occur during mobile banking.

Legal and regulatory frameworks
One study cites lack of mobile phone banking policies for the rural people as a barrier (Mtambalika et al., 2016), evidence that some challenges are created by lack of legal and regulatory frameworks.

Cultural factors
One study (Baptista & Oliveira, 2015) identifies a range of more subtle, cultural factors that can hinder update of mobile banking at the BOP, such as unwillingness to accept change, uncertainty avoidance, and perceived power imbalances between users and banking operators, all of which can be cultural moderators in relation to adoption of mobile banking (Baptista & Oliveira, 2015). The study based in Rwanda (Van der Wansem, 2013) shows that some men do not permit their wives to own mobile phones, thus presenting a clear gender barrier to mobile banking uptake.

Benefits

Convenience and accessibility
Nine of the studies provide findings to suggest that convenient and accessible banking services, for both low- and high-income people, are the major benefit of embracing mobile banking (Baptista & Oliveira, 2015; Mago & Chitokwindo, 2014; Mlitwa & Tshetsha, 2012; Mtambalika et al., 2016; Shrivastava, 2010; Van der Wansem, 2013; Van Deventer et al., 2017). Three of those nine studies focus on the fact that mobile banking reduces time and access barriers (Chukwumah, 2017; Shrivastava, 2010; Van der Wansem, 2013). The Zimbabwe study provides the finding that 79% of the surveyed people indicated that mobile banking provides accessibility benefits (Mago & Chitokwindo, 2014; Tchouassi, 2012; van Deventer et al.).

Reduced handling of cash
The Van der Wansem (2013) study provides the finding that mobile banking provides better financial security since it reduces the handling of cash.

Promotion of financial inclusion
The findings from three studies—conducted in Malawi, Rwanda Sudan—reveal mobile banking's role in increasing the uptake of banking services, thereby promoting financial inclusion (Ammar & Ahmed, 2016; Mtambalika et al., 2016; Van der Wansem, 2013).

Reduced urban-rural divide
The findings from Malawi, Rwanda Sudan studies reveal mobile banking's role in reducing the rural-urban divide (Ammar & Ahmed, 2016; Mtambalika et al., 2016; Van der Wansem, 2013).

Reduced inequality and poverty
The findings from the study in Ghana show an improvement in the economic well-being of people who use mobile banking (Hinson, 2011). Findings from three other studies—across 49 countries (Asongu, 2018), in Nigeria (Chukwumah, 2017), and in Zimbabwe (Mago & Chitokwindo, 2014) reveal mobile banking's ability to reduce inequality and poverty levels by creating new opportunities for the poor.

Adoption dynamics

Technology adoption models
As seen in Table 1, the two technology adoption models found most frequently across the studies are the aforementioned (in section 3):

- technology acceptance model (TAM); and
- unified theory of acceptance and use of technology (UTAUT).

Other models (also described in section 3) that we thought we might find deployed in the studies, but which are not present in the selected studies, are:

- innovation diffusion theory (IDT);
- the information system success model (ISSM);
- the task technology fit (TTF) model; and
- the theory of planned behaviour (TPB).

One model which appears in one of the studies, but which we did not anticipate finding, is the technology-organisation-environment (TOE) model (Tornatzky, Fleischer, & Chakrabarti, 1990), which is deployed, with UTAUT, in the Ammar & Ahmed (2016) Sudan study. Another of the studies employs a non-technology-adoption model, the contestable market theory (Boumol, Panzar, & Willig, 1982), to determine how existing mobile banking agents can compete with others to offer better competitive mobile banking services to the people.

Four studies do not explicitly state the theory or model upon which the research is based.

Perceived usefulness
The findings from six of the studies highlight the key role of perceived usefulness in driving adoption of mobile technology (Ammar & Ahmed, 2016; Baptista & Oliveira, 2015; Chukwumah, 2017; Mago & Chitokwindo, 2014; Mtambalika et al., 2016; Shrivastava, 2010).

Perceived ease of use
Five studies provide findings that confirm the role of ease of use in driving mobile technology adoption (Ammar & Ahmed, 2016; Baptista & Oliveira, 2015; Mago & Chitokwindo, 2014; Mtambalika et al., 2016; Shrivastava, 2010).

Perceived convenience and accessibility
Four of the studies indicate convenience and accessibility as other determining factors for adoption of mobile banking (Bankole & Cloete, 2011; Chukwumah, 2017; Mago & Chitokwindo, 2014; Van der Wansem, 2013).

Cost
Findings from four studies point to cost as a key factor guiding adoption or non-adoption of mobile technologies, including mobile banking (Ammar & Ahmed, 2016; Chukwumah, 2017; Shrivastava, 2010; Van der Wansem, 2013).

Security
Four studies provide findings pointing to security as a major factor influencing adoption or non-adoption of mobile banking (Ammar & Ahmed, 2016; Mago & Chitokwindo, 2014; Mlitwa & Tshetsha, 2012; Van der Wansem, 2013).

Other factors found to influence adoption of mobile banking are:

- perceived performance of mobile banking systems (Ammar & Ahmed, 2016; Baptista & Oliveira, 2015);
- effort required to use mobile banking (Ammar & Ahmed, 2016);
- credibility (Ammar & Ahmed, 2016; Shrivastava, 2010);
- perceived privacy (Ammar & Ahmed, 2016);
- social influences (Ammar & Ahmed, 2016; Bankole & Cloete, 2011);
- needs or benefits from using mobile banking (Ammar & Ahmed, 2016; Van der Boor et al., 2014);
- integrity (Van Deventer et al., 2017);
- age and gender (Tchouassi, 2012; Van der Boor et al., 2014);
- awareness (Bankole & Cloete, 2011; Mlitwa & Tshetsha, 2012);
- availability of information and communication technology (ICT) products and services (Tchouassi, 2012; Van der Boor et al., 2014); and
- cultural dynamics (Bankole & Cloete, 2011; Van der Boor et al., 2014).

Table 2, provided over the next four pages (pp. 39-42), summarises the key findings, from the 14 studies, in respect of challenges, benefits, and adoption dynamics of mobile banking at the BOP in Africa.

Table 2: Findings from the 14 studies

Author(s) (year): Country(ies), region	Challenges	Benefits	Adoption dynamics
Chukwumah (2017): Nigeria	• High levels of non-awareness of mobile banking in rural areas e.g., 20% own a bank account while 86% have never heard of mobile banking • Many people in the rural areas do not own bank accounts • Limited access to internet • Lack of trust in bank or banking staff • Fear of unsecure transactions such as fraud	• Mobile banking reduces time and access barriers to banking services • Mobile banking makes accessing banking services affordable and convenient	• Perceived convenience and trust found to have a positive impact on adoption of mobile banking in the rural areas • Perceived usefulness not found to be significant, since many people preferred to keep money at home • Affordability of mobile banking services, such as alerts, found to influence adoption
Mago and Chitokwindo (2014): Zimbabwe	• Inaccessibility due to limited cellular network connectivity for mobile telephony and mobile internet • High mobile data prices • Perceived insecurity of online transactions	• 79% feel mobile banking benefits people Mobile banking: • reduces transport costs • is easily accessible to both low- and high-income people • is easy to use • is affordable	• Perceived ease of use, security, convenience, and accessibility all found to influence adoption of mobile banking
Ammar and Ahmed (2016): Sudan	• Lack of awareness of mobile banking (48% were unaware of mobile banking) • Perceived high financial costs in using mobile banking • Limited innovation of mobile banking products and services • Customer illiteracy • Limited cellular network connectivity for both mobile telephony and mobile internet	• Better access to financial services	• Performance expectancy (perceived usefulness) identified by 77% of respondents, effort expectancy (perceived ease of use) by 72%, and perceived credibility (security and privacy) by 71%—all of which were found to affect the adoption of mobile banking • Social influence, perceived financial cost, and banking found not to influence the adoption of mobile banking

Author(s) (year): Country(ies), region	Challenges	Benefits	Adoption dynamics
Van der Wansem (2013): Rwanda	• Mobile phones not affordable to many people • Limited cellular network coverage for both mobile telephony and mobile internet • Little knowledge of how to use phones for mobile banking • Cultural values, as some men do not allow women to own phones • Elderly people have little interest in using phones for mobile banking	• Time savings and convenience of access • Better accessibility • Security and reduced cash handling • Better customer service experience	• Perceived challenges, such as security, accessibility, financial cost and trust, found to influence adoption of mobile banking • Perceived benefits, such as time-saving and convenience of access, found to influence adoption
Bankole and Cloete (2011): South Africa, Nigeria	• Security the major concern	• Not specifically quantified	• Cultural differences in birth countries found to influence adoption of mobile banking • Awareness, convenience and literacy level found to impact adoption • Social factors found to influence adoption in South Africa, but not in Nigeria
Mtambalika, Manda, Gombachika and Kunyenje (2016): Malawi	• Security concerns • Lack of mobile banking policies to support and target rural people • Lack of mobile banking regulation framework	• Banks reach out to more people at the BOP • Customers not required to visit bank branches	• Perceived ease of use, perceived usefulness, presence of mobile network and retail agents found to influence behavioural intention to use the bank-led mobile banking model
Hinson (2011): Ghana, Africa	• Long geographical distances to access banking services, including opening a bank account • Bureaucratic nature of banking services prompt people to shun banks • High illiteracy levels • Low awareness levels in relation to mobile banking	• Improved economic well-being • Improved remittance flows • Decreased information asymmetry	• Not specifically stated

Author(s) (year): Country(ies), region	Challenges	Benefits	Adoption dynamics
Tchouassi (2012): 30 Sub-Saharan African countries	• Poor network infrastructure in rural areas to support mobile telephony and mobile internet • Lack of bank accounts due to irregular income, costs in maintaining bank accounts, and lack of trust in banks	• New channel for banking	• Rate of adoption found to be influenced by: availability of ICT devices, income, age, education, gender, family, occupation, living place, phone utilisation
Van der Boor, Oliveira and Veloso (2014): Zambia, Kenya	• Not specifically stated	• Users benefit a lot from innovation of mobile banking if they are fully involved in developing technological products and services service innovators • Users in developing countries are an important source of innovation in mobile banking, contributing to 50% of innovations	Factors contributing to innovation are: • Increasing access to ICT • Flexible platforms • Increasing client need to transact and communicate globally
Shrivastava (2010): South Africa	• Limited access to mobile banking services due to poor cellular network connectivity for mobile telephony and mobile internet • Low level of ownership of bank accounts	• Time saving through not traveling to banks • Reduced transport costs • Mobile banking support for communication and financial transactions in health, farming	• Mobile banking adoption found to be impacted by perceived usefulness, ease of use, credibility, self-efficacy, financial cost, enhanced image of mobile banking users, and perceived improvement of life • Perceived usefulness found to have the strongest influence on mobile banking adoption
Asongu (2018): 49 African countries	• Uneven development in terms of internet penetration versus mobile phone penetration	• Reduction of the rural/urban divide • Financial inclusion in the rural areas	• Positive correlation found between mobile banking and trade openness, internet penetration, human development, patent applications

Author(s) (year): Country(ies), region	Challenges	Benefits	Adoption dynamics
Van Deventer, De Klerk and Bevan-Dye (2017): South Africa	• Perceived risk and uncertainty in using mobile banking • Perceived lack of system quality, e.g., for provision of accurate and relevant information	• Speedy access to mobile banking services	• Trust in using mobile banking services found to be positively associated with integrity and system quality
Mlitwa and Tshetsha (2012): South Africa	• Lack of awareness • Limited cellular connectivity for mobile telephony and mobile internet • Low literacy levels • Lack of trust in mobile banking • Security threats	• Saves time instead of travelling to the bank • Saves transport costs • Ubiquitous access to the banking services at any time	• Security concerns and awareness of mobile phone use found to affect adoption of mobile banking
Baptista and Oliveira (2015): Mozambique	• Many gradations of acceptance of mobile banking by clients due to cultural values, usefulness and ease of use of the mobile banking technology • Lack of necessary skills to use mobile banking	• Increased access to banking services • Mobile banking is time and place independent • Banks reduce operational costs by embracing mobile banking	• Users' level of confidence via getting benefits from mobile banking activities, users' level of fun or pleasure from using mobile banking, and users' habits (such as results from previous experiences or frequency of any past behaviour), impact positively on behaviour intention to adopt mobile banking • Collectivism, uncertainty avoidance, short-termism (people who expect quick results easily adopt mobile banking), and societal power (if senior people accept mobile banking, it is likely to be accepted by their subordinates) were found to be significant cultural moderators.

7. Recommendations

Our systematic review of 14 existing studies has managed to identify a range of compelling existing findings—as outlined and analysed in the previous section of this article—in respect of challenges, benefits, and adoption dynamics of mobile banking at the BOP in Africa. In this section we offer, based on the existing findings, recommendations for improved implementation of mobile banking at the BOP on the continent.

An enabling, competitive environment for mobile banking

Policymakers need to strive to create an enabling, competitive environment for mobile banking services among all key stakeholders such as telecom operators, internet providers, banks, and non-governmental organisations. Competition among players can be expected to encourage adoption of technologies and platforms that provide accessible, affordable, open, and safe mobile banking services to consumers.

Partnerships among key stakeholders

There need to be partnerships among certain key stakeholders in support of elements necessary for increased mobile banking takeup at the BOP in Africa. For example, stakeholder collaboration is needed in support of increased access to, and adoption of, mobile internet connectivity. Stakeholders must also work together to formulate and implement policies and strategies that support financial literacy; mobile banking user education; and development of relevant, customisable and user-friendly interfaces. The overall goal of partnerships needs to be the development of accountable and transparent mobile banking ecosystems in Africa that are characterised by innovation, efficiency and inclusion.

Ease of opening bank accounts

Initiatives need to be formulated to make it increasingly straightforward for a new customer to open a bank account. Many banks require that new accounts must have a minimum opening balance, and that account-holders must maintain a minimum balance—two requirements that must be reviewed and revised, because they are barriers to many people at the BOP in Africa.

Awareness-raising

Governments and other key stakeholders need to work together to build awareness of mobile banking services. Specifically, awareness campaigns need to address the cultural factors highlighted by this review: unwillingness to accept change, uncertainty avoidance, perceived power imbalances between users and banking operators, and gender-based barriers. In addition, in order to enhance trust in mobile banking services, stakeholders need to make sure that customers are aware of, and protected as much as possible against, cybersecurity vulnerabilities and threats.

Infrastructure use and development

Banks need to use the already existing mobile networks to offer mobile banking to rural, unbanked people. Since it is proven that ICT infrastructure positively impacts on the success of the adoption of mobile banking, all key stakeholders must collaborate to improve the network availability and infrastructure. Deliberate initiatives must be set up to sustain high levels of ICT expertise.

Consumer/user focus

There is a need for policymakers, company managers and system developers to embrace more customer-centric approaches when implementing mobile banking solutions, in order to make mobile banking applications more user-friendly for people at the BOP in Africa. In particular, greater attention needs to be paid to the needs of rural people who are illiterate or only partially literate, and/or people who can only speak and/or read a minority language. It is recommended that mobile banking interfaces gradually be developed in all of the languages spoken on the continent, and that the interfaces provide the option of verbal-only interaction for those who cannot read and write.

Policy, law and regulation

African governments need to set up retail banking policies that allow mobile network operators to start directly offering mobile banking services. Key players in the mobile banking sector must work together to set up legal and regulatory frameworks that, among other things, generate standards for interoperability of various mobile banking application platforms, and ensure security controls to address the security, privacy and confidentiality concerns of the users. It is also important to ensure that laws and policies governing both the digital infrastructure and retail banking are not too strict but also flexible enough so that innovation and competition of mobile banking services can be enhanced.

8. Conclusion

This systematic review has identified perceived challenges that hamper the adoption of mobile banking by people at the BOP in Africa, including poor mobile internet connectivity; lack of awareness of mobile banking services; illiteracy; poverty; lack of trust due to perceived security risks; lack of legal and regulatory frameworks in support of mobile banking; and cultural factors.

The review has also identified perceived benefits of mobile banking among people at the BOP in Africa, including convenience and accessibility; reduced handling of cash; increased financial inclusion; reduction of the urban-rural divide; and reduced inequality and poverty.

Furthermore, this review has identified a variety of dynamics impacting upon adoption of mobile banking by people at the BOP in Africa, including perceived

usefulness; perceived ease of use; perceived convenience and accessibility; cost; security; perceived performance of mobile banking systems; perceived privacy; social influences; perceived needs and benefits from use of mobile banking; perceived mobile banking integrity and system quality; awareness; availability of ICT products and services; and cultural dynamics.

Finally, we provided recommendations for improved implementation of mobile banking in Africa, in the following categories: an enabling, competitive environment; partnerships among key stakeholders; ease of opening bank accounts; awareness-raising; infrastructure use and development; consumer/user focus; and policy, law and regulation.

It must be noted that, in our systematic review, we focused exclusively on African contexts in respect of challenges, benefits, and adoption dynamics of mobile banking for people at BOP. A broader systematic review, spanning across a wider range of developing-world contexts including contexts outside Africa, would be of great value—in order to broaden the understanding of how mobile technologies can facilitate affordable access to banking products for the world's most vulnerable groups.

References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl, & J. Beckmann (Eds.), *Action control* (pp. 11-39). Berlin: Springer. https://doi.org/10.1007/978-3-642-69746-3_2

Alafeef, M., Singh, D., & Ahmad, K. (2012). The influence of demographic factors and user interface on mobile banking adoption: A review. *Journal of Applied Sciences, 12*(20), 2082–2095. https://doi.org/10.3923/jas.2012.2082.2095

Ammar, A., & Ahmed, E. M. (2016). Factors influencing Sudanese microfinance intention to adopt mobile banking. *Cogent Business & Management, 3*(1), 1–20. https://doi.org/10.1080/23311975.2016.1154257

Asongu, S. A. (2018). Conditional determinants of mobile phones penetration and mobile banking in Sub-Saharan Africa. *Journal of the Knowledge Economy, 9*(1), 81–135. https://doi.org/10.1007/s13132-015-0322-z

Bankole, O., & Cloete, E. (2011). *Mobile banking: A comparative study of South Africa and Nigeria.* Paper presented at IEEE Africon '11, Livingstone, Zambia. https://doi.org/10.1109/AFRCON.2011.6072178

Baptista, G., & Oliveira, T. (2015). Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators. *Computers in Human Behavior, 50*, 418–430. https://doi.org/10.1016/j.chb.2015.04.024

Beck, T., & Cull, R. (2013). *Banking in Africa.* Policy Research Working Paper 6684. Washington, DC: World Bank. https://doi.org/10.1596/1813-9450-6684

Baumol, W. J., Panzar, J. C., & Willig, R. D. (1982). *Contestable markets and the theory of industry structure.* San Diego. CA: Harcourt Brace Jovanovich.

Brown, I., Cajee, Z., Davies, D., & Stroebel, S. (2003). Cell phone banking: Predictors of adoption in South Africa - an exploratory study. *International Journal of Information Management, 23*(5), 381–394. https://doi.org/10.1016/S0268-4012(03)00065-3

Chavan, J. (2013). Internet banking - benefits and challenges in an emerging economy. *International Journal of Research in Business Management, 1*(1), 19–26.

Chukwumah, S. (2017). *Adoption of mobile banking in rural Nigeria.* Master's thesis, University of Turku, Finland.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar. S., & Hess, J. (2017). *Global findex database 2017: Measuring financial inclusion and the fintech revolution*. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1259-0

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems, 19*(4), 9–30. https://doi.org/10.1080/07421222.2003.1104574.8

Gebauer, J., & Shaw, M. J. (2004). Success factors and impacts of mobile business applications: Results from a mobile e-procurement study. *International Journal of Electronic Commerce, 8*(3), 19–41. https://doi.org/10.1080/10864415.2004.11044304

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly, 19*(2), 213–236. https://doi.org/10.2307/249689

GSM Association (GSMA). (2016). *The mobile economy: Africa 2016.* London: GSMA.

GSMA. (2018a). *The mobile economy 2018*. London: GSMA.

GSMA. (2018b). *The mobile economy: Sub-Saharan Africa 2018*. London: GSMA. Retrieved from https://www.gsma.com/mobileeconomy/sub-saharan-africa

GSMA. (2018c). *The mobile economy: West Africa 2018*. London: GSMA. Retrieved from https://www.gsma.com/mobileeconomy/west-africa/

GSMA. (2018d). *The mobile economy: Middle East and North Africa 2018*. London: GSMA. Retrieved https://www.gsma.com/mobileeconomy/mena/

Gu, J.-C., Lee, S.-C., & Suh, Y.-H. (2009). Determinants of behavioral intention to mobile banking. *Expert Systems with Applications, 36*(9), 11605–11616. https://doi.org/10.1016/j.eswa.2009.03.024

Hinson, R. E. (2011). Banking the poor: The role of mobiles. *Journal of Financial Services Marketing, 15*(4), 320–333. https://doi.org/10.1057/fsm.2010.29

Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & Management, 48*(1), 1–8. https://doi.org/10.1016/j.im.2010.09.001

Internet World Stats. (2018). The internet big picture: World internet users and 2018 population stats. Retrieved from https://www.internetworldstats.com/stats.htm

Ivatury, G., & Mas, I. (2008). *The early experience with branchless banking*. Focus Note 46. Washington, DC: CGAP.

Jolliffe, I. T. (2002). *Principal component analysis* (2nd ed.). New York: Springer. https://doi.org/10.1007/b98835

Kemp, S. (2017). *Digital in 2017: Global overview*. We Are Social and Hootsuite. Retrieved from https://wearesocial.com/special-reports/digital-in-2017-global-overview

Kemp, S. (2018). *Digital in 2018*. We Are Social and Hootsuite. Retrieved from https://hootsuite.com/pages/digital-in-2018

Kopala, M. R. (2010). Mobile banking: A tool of financial inclusion for India. SSRN. http://dx.doi.org/10.2139/ssrn.1674328

Lee, K. C., & Chung, N. (2009). Understanding factors affecting trust in and satisfaction with mobile banking in Korea: A modified DeLone and McLean's model perspective. *Interacting with Computers, 21*(5-6), 385–392. https://doi.org/10.1016/j.intcom.2009.06.004

Mago, S., & Chitokwindo, S. (2014). The impact of mobile banking on financial inclusion in Zimbabwe: A case for Masvingo Province. *Mediterranean Journal of Social Sciences, 5*(9), 221–230. https://doi.org/10.5901/mjss.2014.v5n9p221

Majchrzak, A., Rice, R. E., Malhotra, A., King, N., & Ba, S. (2000). Technology adaptation: The case of a computer-supported inter-organizational virtual team. *MIS Quarterly, 24*(4), 569–600. https://doi.org/10.2307/3250948

Mallat, N., Rossi, M., & Tuunainen, V. K. (2004). Mobile banking services. *Communications of the ACM, 47*(5), 42–46. https://doi.org/10.1145/986213.986236

Mbiti, I., & Weil, D. N. (2011). *Mobile banking: The impact of M-Pesa in Kenya*. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w17129

Mlitwa, N. B. W., & Tshetsha, N. (2012). Adoption of cell-phone banking among low-income communities in rural areas of South Africa. *iBusiness 4*(4), 362–370. https://doi.org/10.4236/ib.2012.44045

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine, 151*(4), 264–269. https://doi.org/10.7326/0003-4819-151-4-200908180-00135

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research, 2*(3), 192–222. https://doi.org/10.1287/isre.2.3.192

Morawczynski, O. (2009). Exploring the usage and impact of "transformational" mobile financial services: The case of M-PESA in Kenya. *Journal of Eastern African Studies, 3*(3), 509–525. https://doi.org/10.1080/17531050903273768

Mtambalika, A., Manda, T. D., Gombachika, H., & Kunyenje, G. (2016). Branchless banking in rural Malawi: Potential customers' perspective on bank-led mobile banking. In P. Cunningham & M. Cunningham (Eds.), *IST-Africa 2016 conference proceedings*. https://doi.org/10.1109/ISTAFRICA.2016.7530701

Nasri, W., & Charfeddine, L. (2012). Factors affecting the adoption of Internet banking in Tunisia: An integration theory of acceptance model and theory of planned behavior. *The Journal of High Technology Management Research, 23*(1), 1–14. https://doi.org/10.1016/j.hitech.2012.03.001

Oliveira, T., Faria, M., Thomas, M. A., & Popovič, A. (2014). Extending the understanding of mobile banking adoption: When UTAUT meets TTF and ITM. *International Journal of Information Management, 34*(5), 689–703. https://doi.org/10.1016/j.ijinfomgt.2014.06.004

Porteous, D. (2006). *The enabling environment for mobile banking in Africa*. For UK Department for International Development (DFID). Retrieved from https://www.microfinancegateway.org/sites/default/files/mfg-en-paper-the-enabling-environment-for-mobile-banking-in-africa-may-2006_0.pdf

Prahalad, C. K. (2006). *The fortune at the bottom of the pyramid: Eradicating poverty through profits.* Upper Saddle River, NJ: Pearson Education. https://doi.org/10.1111/j.1468-0270.2008.864_4.x

Rammile, N., & Nel, J. (2012). Understanding resistance to cell phone banking adoption through the application of the technology acceptance model (TAM). *African Journal of Business Management, 6*(1), 86–97. https://doi.org/10.5897/AJBM11.635

Rogers, E. (1995). *Diffusion of innovations: Modifications of a model for telecommunications* (4th ed.). New York: Free Press. https://doi.org/10.1007/978-3-642-79868-9_2

Shih, K.-H., Hung, H.-F., & Lin, B. (2010). Assessing user experiences and usage intentions of m-banking service. *International Journal of Mobile Communications, 8*(3), 257–277. https://doi.org/10.1504/IJMC.2010.032974

Shih, Y.-Y., & Fang, K. (2004). The use of a decomposed theory of planned behavior to study internet banking in Taiwan. *Internet Research, 14*(3), 213–223. https://doi.org/10.1108/10662240410542643

Shrivastava, P. (2010). Build it – will they come? A study of the adoption of mobile financial services by low income clients in South Africa. *Journal of Electronic Commerce in Organizations (JECO), 8*(3), 1–14. https://doi.org/10.4018/jeco.2010070101

Tchouassi, G. (2012). Can mobile phones really work to extend banking services to the unbanked? Empirical lessons from selected Sub-Saharan Africa countries. *International Journal of Developing Societies, 1*(2), 70–81. https://doi.org/10.11634/21681783150489

Tobbin, P. (2012). Towards a model of adoption in mobile banking by the unbanked: A qualitative study. *info, 14*(5), 74–88. https://doi.org/10.1108/14636691211256313

Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). *The processes of technological innovation.* Lanham, MD: Lexington Books, Rowman and Littlefield.

Van der Boor, P., Oliveira, P., & Veloso, F. (2014). Users as innovators in developing countries: The global sources of innovation and diffusion in mobile banking services. *Research Policy, 43*(9), 1594–1607. https://doi.org/10.1016/j.respol.2014.05.003

Van der Wansem, S. (2013). *Financial inclusion: Banking on mobile phones?* Master's dissertation, Wageningen University, The Netherlands. Retrieved from http://edepot.wur.nl/317936 (871108-928040)

Van Deventer, M., De Klerk, N., & Bevan-Dye, A. (2017). Influence of perceived integrity and perceived system quality on Generation Y students' perceived trust in mobile banking in South Africa. *Banks and Bank Systems, 12*(1), 128–134. http://dx.doi.org/10.21511/bbs.12(1-1).2017.05

Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research, 11*(4), 342–365. https://doi.org/10.1287/isre.11.4.342.11872

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences, 39*(2), 273–315. https://dx.doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences, 27*(3), 451–481. https://doi.org/10.1111/j.1540-5915.1996.tb00860.x

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. http://dx.doi.org/10.2307/30036540

World Bank. (n.d.). Financial inclusion. Retrieved from https://www.worldbank.org/en/topic/financialinclusion

World Bank (2016). *Poverty and shared prosperity 2016.* Retrieved from http://www.worldbank.org/en/publication/poverty-and-shared-prosperity

World Bank. (2012). *Information and communications for development 2012: Maximizing mobile*. https://doi.org/10.1596/978-0-8213-8991-1

Yu, C. S. (2012). Factors affecting individuals to adopt mobile banking: Empirical evidence from the UTAUT model. *Journal of Electronic Commerce Research, 13*(2), 104–121. Retrieved from http://www.jecr.org/sites/default/files/13_3_p01_0.pdf

Zhou, T., Lu, Y., & Wang, B. (2010). Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behavior, 26*(4), 760–767. https://doi.org/10.1016/j.chb.2010.01.013

Perceptions of Scratch Programming among Secondary School Students in KwaZulu-Natal, South Africa

Mudaray Marimuthu
Lecturer, School of Management, IT and Governance, University of KwaZulu-Natal, Westville, Durban

Predhayen Govender
Honours Graduate, School of Management, IT and Governance, University of KwaZulu-Natal, Westville, Durban

Abstract
Scratch programming was designed with the aim of helping students to develop their logical thinking skills as well as enhancing their problem-solving capabilities, without having the technical distractions associated with more advanced programming languages such as Java. This study, guided by the technology acceptance model (TAM), focused on exploring the associations between perceived usefulness, perceived ease of use, attitude towards use, and behavioural intention to use the Scratch programming language, with the aim of identifying how Scratch programming was perceived by a group of South African students in Grades 10 and 11 at two high schools. Results indicated, among other things, that Grade 10 students perceived Scratch to be easy to use and useful, and Grade 11 students found it to be easy to use but useful only in learning introductory programming concepts. These and other findings suggest that while Scratch helps students understand logic and problem-solving, it does not assist sufficiently in preparing them for using a higher-level programming language such as Java. The article concludes with recommendations for South African education policymakers, including proposals that a bridging programming language be introduced between Scratch and Java, and that Scratch be introduced much earlier than in Grade 10.

Keywords
Scratch, Java, secondary school students, technology acceptance model (TAM), programming language adoption, visual programming, logical thinking, problem-solving, education, education policy, curriculum, KwaZulu-Natal, South Africa

DOI: https://doi.org/10.23962/10539/26112

Recommended citation
Marimuthu, M. & Govender, P. (2018). Perceptions of Scratch programming among secondary school students in KwaZulu-Natal, South Africa**.** *The African Journal of Information and Communication (AJIC), 21,* 51–80.
https://doi.org/10.23962/10539/ 26112

This article is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence:
http://creativecommons.org/licenses/by/4.0

1. Introduction

Computer programming is recognised as a vital competence for establishing problem-solving abilities as well as logical and analytical reasoning. Its integration throughout various educational levels is regarded as valuable, with many studies carried out to further explore this phenomenon (see, for example, Annamalai & Salam, 2017; Fessakis, Gouli, & Mavroudi, 2013; Isa & Derus, 2017; Meyerovich & Rabkin, 2013; Ozmen & Alten, 2014; Tom, 2015).

Studies within the field of computer science have revealed a lack of problem-solving and computational skills among students in introductory programming courses, despite programming becoming so important in the 21st century (Papadopoulos & Tegos, 2012; Tan, Ting & Ling, 2009; Robins, Rountree & Rountree, 2003).

The Scratch programming language was designed and developed at the Massachusetts Institute of Technology (MIT) Media Lab with the intention of simplifying the process of developing and programming animations, interactive stories, and games. Lamb and Johnson (2011) state that, with respect to computer software, the term "scratching" refers to reusable code segments that can be instrumentally and functionally adapted to new scenarios and used for other purposes. The word "scratch" is said to be derived from the turntablism method of scratching, with the Scratch programming platform associating the technique of mixing sounds to the mixing of software projects. Through Scratch programming, users can upload web-based or downloaded software projects to the website for sharing purposes. Credit is awarded to the participants who develop the initial programs.

Scratch is primarily focused on children and teenagers, with the intention of conveying computational thinking using a simple but cogent building-block approach in the software development process, focused less on programming detail than on emphasising the problem-solving aspects (Maloney, Resnick, Rusk, Silverman, & Eastmond, 2010). Scratch offers young individuals the freedom to "imagine, program and share" (Housand & Housand, 2011, p. 22). Scratch does not require any programming knowledge, and has an intuitive interface, noted as a necessity for its young audience. With Scratch, users are able to build scripts by selecting blocks of code that govern motion, color and sensors. These scripts define specific operations with respect to the program's objects. The building blocks of Scratch programming make it easy for users to piece together the necessary programming elements without programming knowledge (Watters, 2011).

Since the release of Scratch in 2007, more than 850,000 users have joined the Scratch website and have shared almost two million projects, many of which are animations or games. The ability for users to easily share information has become a fundamental feature of the Scratch platform. Uploaded projects are licensed under the Creative Commons Attribution Share Alike licence. This entails users freely downloading

graphics and source code from online projects and reusing components from them with minimal constraint (Watters, 2011).

According to Meyerovich and Rabkin (2013), programming languages such as Java, C and C# are widely popular. Understanding the factors of a successfully adopted language can help inform efforts by advocates and language designers to influence the languages' comprehensive function and design. Educators often encounter problems with the teaching processes associated with programming logic and skills, which calls into question teaching methodologies. Studies have shown that many students lack problem-solving and computational thinking abilities (Papadopoulos & Tegos, 2012) and these skills have been identified as important competencies in the 21st century (Marques & Marques, 2012).

Education authorities in South Africa want Grade 10 students to learn basic programming principles and constructs with a fun and easy-to-learn tool. Therefore Scratch has been implemented in schools to introduce students to "important computational skills and concepts, algorithm development, problem solving and programming" (Department of Basic Education, 2011, p. 12). Our study aimed to measure the acceptance of Scratch programming by Grade 10 and 11 students by analysing whether perceived usefulness, attitude to use and perceived ease of use influence students' behavioural intention to use Scratch, which in turn can be expected to influence its acceptance. The framework for the study was grounded in the technology acceptance model (TAM).

The research questions underpinning the study were:

1) To what extent does perceived usefulness influence a student's behavioural intention to use Scratch programming?
2) To what extent does perceived ease of use influence a student's behavioural intention to use Scratch programming?
3) To what extend does the attitude towards using Scratch influence a student's behavioural intention to use Scratch?
4) Are there differences in perceptions between Grade 10 and Grade 11 students in respect of perceived usefulness, perceived ease of use, attitude towards using, and behavioural intention to use Scratch programming?
5) Does teaching Scratch in Grade 10 make it easier for learners in Grade 11 to learn Java?

2. Literature review and theoretical framework

Problems with learning programming

Factors that have been found to affect teaching programming to young individuals include applying programming concepts to situations involving complex problems, syntax complexity, and associating programming with tasks unrelated to the interests

or thought processes of young individuals (Maloney et al., 2010). Papadopoulos and Tegos (2012) similarly state that studies within the field of computer science have shown that students lack problem-solving as well as logical thinking abilities. Robins et al. (2003) identify the most crucial shortcomings with students learning programming as being associated with problem-solving activities, developing and designing solutions, and expressing the designed solutions as programs.

Many programming languages are difficult to comprehend to the untrained eye, due to a mixture of English and unfathomable programming language syntax. Programming syntax is the set of rules and symbols of a programming language, which enable a programmer to create correctly-structured programs. The sheer magnitude of syntax and keywords in a basic Java program would defy explanation on the first day of an introductory programming class. Although the "mastery of precision" can be seen as fundamental when learning programming (Malan & Leitner, 2007), in the early stages of an introductory course it can often be found that semicolons, parentheses and other syntactical elements delay and discourage students from understanding significant programmatic constructs such as variables, conditionals, loops or even the logic itself (Malan & Leitner, 2007). Many programming languages, Java included, compel students to grasp the programmatic overheads before actually programming.

Several studies have found that students encounter difficulties with the initial steps of programming. A study by McCracken et al. (2001) found that students in their first one or two courses in computer science experienced difficulties with the reading, writing and designing of code. Tan et al. (2009) conducted a survey to determine the possible factors that lead to problems with learning programming. Taking into consideration students' computing experience and background, Tan et al. (2009) concluded that the majority of students encountered problems with memory-related concepts such as the storage and manipulation of variables in the computer's main memory. This finding concurs with that of Milne and Rowe (2002), who found that many students were incapable of developing a simple "mental model of memory movement" during the execution of the program. Beginner programmers lack clear mental models and fail to apply the relevant knowledge. They focus more on little problems rather than on the planning and testing of code (Milner & Rowe, 2002).

According to Rudder, Bernard and Mohammed (2007), an effective method for students to learn programming is to translate real-world problems into code, and solve them accordingly. However students have found this method to be difficult, since daily real-world situations are in a single context while the task of learning programming is considered a multilayered skill. Multilayered skills are abstract since programming languages are designed for the unfamiliar realm of computers rather than the natural world experienced by people when growing up (Moser, 1997).

Ozmen and Alten (2014), and Bosse and Gerosa (2017), indicate that many problems with students learning computer programming stem from the complexity of programmatic constructs such as programming syntax, variables, functions, and loops. Complexities such as these may be seen as a barrier for students to learn programming and may even hinder their motivation to learn.

Effectiveness of using programming and visual tools

Due to the rapid growth of digital technology "individuals are required to use a growing variety of technical, cognitive, and sociological skills in order to perform tasks and solve problems in digital environments" (Eshet-Alkalai, 2004, p. 93). To assist in the attaining of these skills, teaching students to program has been introduced into primary and secondary education curriculums.

Pendergast (2006) states that the significance of a well-constructed introduction to programming course cannot be over-emphasised, as it was observed that many students found difficulties with understanding the programming process as well as familiarising themselves with the various programming constructs. Visual programming tools like Alice, a programming language developed by Carnegie Mellon University, and Scratch, are favoured with younger introductory students (Lye, & Koh, 2014). Alice, which was developed before Scratch, is used to teach students general programming concepts as well as object-oriented programming (OOP) concepts. Much effort has gone into the development of visual programming tools for young individuals (Meerbaum-Salant, Armoni, & Ben-Ari, 2013), with these tools being used by young children and as a preliminary learning tool for secondary schools and universities. Visual programming tools such as these create a non-threatening, fun environment for students to develop software, in a way that aims to reduce the anxiety and fear often associated with learning programming (Meerbaum-Salant et al., 2013). It is believed that through these environments, students will be more open to continuing their study of programming.

A study by Boyle, Bradley, Chalk, Jones and Pickard (2003) focused specifically on a "visual approach", making use of graphical shapes to teach abstract programming concepts which were available to students in a virtual learning environment (VLE). Boyle et al. (2003) implemented this approach with an introduction to programming course, and found a 12% to 23% increase in the pass rate over the previous year's students who did not have a VLE- and a graphics-based approach. The results of a questionnaire handed to students during mid-semester showed that 95% of students judged the graphics-based approach to learning programming to be "good" or "very good" (Boyle et al., 2003).

Prior to the development of Scratch, there were many other programming environments, such as Alice, Logo and Karel, all attempting to make learning programming simpler for the beginner programmer. Alice, Karel and Scratch are

all visual programming environments. If Alice, Logo and Karel have one weakness, it is their steeper learning curve than that of Scratch (Malan & Leitner, 2007). Programming tools such as Logo have been viewed as an opportunity for students to expand their intellectual capabilities to take on challenging problems (Papert, 1980). However, it has been noted that programming languages such as Logo have not flourished as expected (Mannila, Peltomaki, & Salakoski, 2006). According to Lee (2011), many of the difficulties encountered by students when using Logo can be attributed to the limitations of the programming tool. One particular example stems from syntactic constraints. In Logo, every line of code must comply with the syntactic constraints (the programming language rules) before the program can be tested. A fragile environment such as this could see students paying more attention to the syntax of the program, while less emphasis is placed on the semantic meaning. Lee (2011) found that

> One of the reasons for the low adoption of computer programming in K–12 education is the time it takes for (especially young) students to learn computer programming using a textbased programming language, which requires an understanding of computer programming language syntaxes and constructs and strong keyboarding skills. (Lee, 2011, p. 27)

Alice is a free interactive 3D-programming tool to help students gain exposure to OOP concepts (Ebrahimi, Geranzeli, & Shokouhi, 2013). With Alice, students are able to learn fundamental programming concepts in the form of creating video games or animations in a visual programming environment, unlike Logo and Karel where the environment in text-based, thereby creating a steeper learning curve.

In recent years, Scratch and Alice have both been used at university level in introductory computer science courses. Lewis (2010) found that new languages like Scratch are often developed and modeled from existing languages, to provide new functionality while offering claimed pedagogical advantages. Scratch reduces the syntax complexity of Alice, which has class-based OOP and emphasises Java or Java-related concepts (Maloney et al., 2010). Lewis (2010) conducted a study which built upon existing research, aimed at testing the pedagogical claims of new programming environments. The study assessed Scratch's pedagogical value in contrast with Logo. Lewis (2010) hypothesised that students who learnt programming using Scratch, as opposed to using Logo, would be more confident about their skills as programmers, would be more capable of tracing the flow of control of conditions and loops, and would report that learning programming concepts in general was easier. The study found that when interpreting loops, students learning through Scratch and Logo performed similarly, regardless of the fact that Logo was textual while Scratch was visual. The Logo environment was thus able to support the development of confidence in students when learning programming as well as spike their interest in the field. However, students using Scratch performed better than the Logo students

when interpreting conditionals, and Scratch made general programming concepts easier to interpret and learn.

Parsons and Haden (2007) conducted a study to test whether students currently learning Java would find Alice useful for developing programming competencies with flow-of-control constructs. It was concluded that students struggled to make the connection between work in Alice and "real programming". In an attempt to reduce syntactic constraints, many visual programming languages, Alice included, may be perceived as too "simple" and not related to "real programming" (Lewis, 2010).

Scratch programming

Maloney et al. (2010) define the Scratch programming language as a programming domain allowing individuals, predominantly between the ages of 9 and 17, to learn and understand fundamental programming concepts while also being able to develop purposefully meaningful projects like games or animations. Certain experts in the field are devoted to trying to find feasible and interesting ways of reviving the primary objective of making programming accessible and interesting to young individuals. It was on this basis that the Scratch programming platform was conceived and developed.

Marques and Marques (2012) place emphasis on significant competencies such as problem-solving and critical thinking skills, which are essential for the 21st century. They further state that through the use of Scratch, users are able to positively develop these competencies.

Kim, Choi, Han, and So (2011) designed a computer course for student educators using Scratch, owing to the fact that student educators encountered difficulties mastering programming language syntax. The course was developed with the intention of encouraging computational skills as well as promoting creative thinking. Kim et al. (2011) conclude that Scratch helped student educators grasp fundamental programming concepts and focus implicitly on what they were able to do with Scratch.

Theodorou and Kordaki (2010) used Scratch to design and develop a computer game with the goal of providing high school learners with a learning habitat to promote various programming concepts. It was concluded that Scratch was a very useful environment because the programming is "done by constructing blocks of simple commands and not by writing text commands" (Theodorou & Kordaki, 2010, p. 13). Topalli and Cagiltay (2018) augmented their course curriculum by including game development projects using the Scratch environment. The findings show that Scratch helped learners perform better in introductory programming courses.

The capabilities of the Scratch learning environment are also emphasised by Lee (2011), who suggests that teachers can benefit from the Scratch platform by developing more entertaining and creative materials so that students can free their imaginations in a consequential manner.

Lai and Yang (2011) conducted a study to assess the effect of visual programming, using Scratch, on students' logical and problem-solving abilities. Lai and Yang (2011) posit that problem-solving abilities include "grasping the problem, analysing the problem, finding out solutions and writing program, verifying the solution by testing, and modifying the program according to the result of the test" (p. 6941). They sampled Grade 6 students who had taken a Scratch programming course, and noted a distinct improvement in the students' problem-solving abilities. Hence, it was concluded that visual programming could enhance problem-solving. Similar studies by Calao, Moreno-Leon, Correa and Robles (2015) and Calder (2010) also show that Scratch increases the logical thinking and problem-solving abilities of young students. Korkmaz (2016) found that an educational programme based on Scratch-related game activities resulted in a significant positive contribution to the logical-mathematical thinking skills of students, more so than educational programmes using Lego Mindstorms Ev3 design activities or traditional teaching activities.

A study by Wilson and Moffat (2010) assessed student use of Scratch programming in an Information Technology module for a period of eight weeks. This module was taken by primary school pupils between the ages of 8 and 9. The researchers concentrated on two distinct aspects: whether various programming concepts were efficiently conveyed via Scratch programming (cognitive), and whether it was fun and easy to use (affective). The results showed a moderate increase in student performance and a more enjoyable experience for students, making learning to program a positive experience. The researchers concluded that, for an ideal educational system to implement successful teaching of programming and programming concepts, primary focus should be not only on a student's cognitive dimension but just as importantly the student's emotional state. Kalelioğlu and Gülbahar (2014) claim that Grade 5 students in their study also found the Scratch platform easy to use. It was clear from the study that Scratch does undoubtedly excite. Studies by Permatasari, Yuana and Maryono (2018) and Sáez-López, Román-González and Vázquez-Cano (2016) also demonstrated that students found Scratch to be easy and fun, made them enthusiastic and motivated about learning programming, and even motivated them to continue studies in programming.

A similar study conducted by Baytak and Land (2011) explored the development process employed by Grade 5 students to design and build computer-based games using the Scratch programming language utilising a "learning by doing" approach. It was concluded that students were more likely to enhance their programming abilities and create computer games when the visual-programming software they employed

was suited for their level of experience. Iskrenovic-Momcilovic (2017) demonstrated that by not having syntax complexity, Scratch allowed beginner programmers to solve complex problems quickly.

Scratch programming in the South African context

In 2011, the South African Department of Basic Education introduced its Curriculum and Assessment Policy Statement (CAPS). In terms of CAPS, educators were mandated to introduce Scratch to Grade 10 learners, as a gateway to learning other programming languages such as Java. There is still only limited research (Beyers and Van der Merwe, 2017; Van Zyl, Mentz & Havenga, 2016; Koorsse, Cilliers, Calitz, 2015; Chetty & Barlow-Jones, 2012) on Scratch programming in the South African context and on South African students' perceptions of Scratch and similar tools.

Scratch programming as a platform for introducing Java

According to Malan and Leitner (2007), Scratch can be seen as a viable gateway to programming languages such as Java or Python. Research by Malan and Leitner (2007) found that Scratch not only thrills and excites students in the early stages of programming but also exposes inexperienced students to fundamental programmatic concepts without the "distraction of syntax". Basic fundamental programming concepts are sequence (doing things in the correct order to solve a problem), decisions (e.g., using "if" conditions to execute instructions based on a true or false decision), and repetition (using loops for execution of instructions more than once). Malan and Leitner (2007) found that while Scratch does not support complex programming constructs such as methods, data types, and parameters, many of which could be considered crucial in an introductory course, its simplicity and power to allow inexperienced students to learn fundamentals programming concepts are what keep students engaged and excited. Students, justifying the time spent working on the program, stated that "Scratch is fun to use and really easy to learn, almost addictive in a way" (Malan & Leitner, 2007, p. 5).

However, in the same Malan and Leitner (2007) study, some students stated that they found Scratch negatively influenced their preparation to take on Java. One respondent stated that Scratch was easy and a lot of fun, but not good enough preparation for the jump to the good preparation for Java. Another student comment was:

> I think Scratch didn't really help me with Java. I had fun with Scratch and I see how it could serve as a didactic tool for some people but I would have preferred to jump straight into Java. The elements of programming that Scratch attempts to teach are not particularly difficult to understand and I feel may be 'safely' introduced using Java itself, I feel we could have progressed a lot more into Java had we jumped directly into it. (Malan & Leitner, 2007, p. 6)

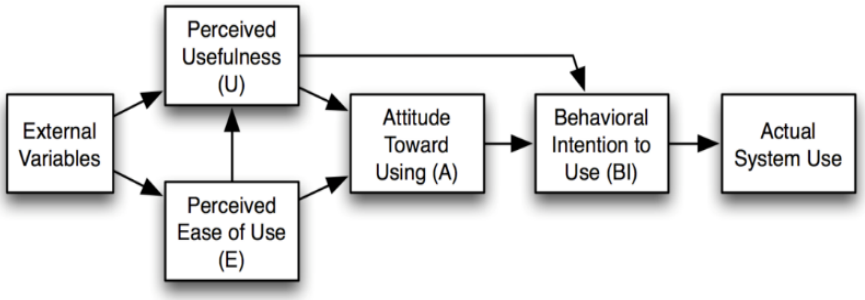
Theoretical framework

The technology acceptance model (TAM) (Davis, Bagozzi & Warshaw, 1989) has been employed, due to its predictive ability, in many studies involving learners (Ibrahim, Leng, Yusoff, Samy, Masrom & Rizman, 2017; Sánchez-Mena, Martí-Parreño & Aldás-Manzano, 2017; Mugo, Njagi, Chemwei & Motanya, 2017; Olivier, 2016; Cakir & Solak, 2014). According to Davis et al. (1989), perceived usefulness (U) is a cognitive evaluation of whether the adoption of a new technology will impact an individual's job performance. Perceived usefulness influences an individual's attitude towards use (A) of new technologies, due to the fact that people tend to form favourable attitudes towards new technologies through the belief that the technologies will impact their job performance in a constructive manner. Perceived usefulness also directly affects the behavioural intention to use (BI) the system. This is based on the idea that, regardless of their personal feelings for the technology, individuals develop intentions to use a device with the belief that it will positively affect job performance, because people are inspired to obtain performance-contingent rewards such as raises or promotions (Davis et al., 1989; Davis, 1989).

Perceived ease of use (E) is found to impact both attitude towards using and perceived usefulness. Self-efficacy of a user is likely to be impacted when a system is easier. An individual with high self-efficacy for a system has strong belief in their ability to use the system, resulting in a more enthusiastic attitude towards the system. Ease of use also directly affects an individual's performance, since the new technology is likely to lead to completion of a task using less effort (Davis et al., 1989; Davis, 1989).

For our study, perceived usefulness was conceptualised as the extent to which a student believes that utilising the Scratch programming language would enhance their programming ability and overall performance in the course. We used perceived ease of use to refer to the degree to which an individual believes that utilising the Scratch programming platform will be free of cognitive effort. Viewed in terms of the TAM framework, the actual usage of Scratch may be determined by the user's behavioural intention to use Scratch, which in turn is determined by the user's overall attitude towards Scratch as well as her or his perception of usefulness and ease of use, i.e., according to Davis et al. (1989), perceived usefulness together with perceived ease of use have a significant influence on attitude, which in turn impacts behavioural intention to use.

Figure 1: TAM, as set out by Davis et al. (1989)



Source: Davis, Bagozzi, and Warshaw (1989, p. 985)

3. Methodology

Research approach

The study used a mixed-method approach, encompassing both qualitative and quantitative data collection and analysis techniques. The mixed-method approach was useful because it allowed the open-ended questions (qualitative) to provide insight and understanding to the quantitative data collected.

Quantitative research focuses on the numbers behind a survey and uses statistics to generalise findings. Quantitative data were used to analyse the associations between the four constructs of TAM—i.e., perceived usefulness, perceived ease of use, attitude towards use, and behavioural intention to use—in order to address the research questions.

Target population and sampling

The target population for this study was 70 Grade 10 and Grade 11 Information Technology students from two secondary schools in South Africa's KwaZulu-Natal Province. The Grade 10 students were learning programming using Scratch, while the Grade 11 students had already made the transition from Scratch to Java. Due to the small population size, all 70 students were targeted for this study.

The questionnaire

The questionnaire consisted of both open-ended and closed-ended questions. Closed-ended questions utilised a 5-point Likert scale to obtain an understanding about students' opinions on the effectiveness of Scratch. The open-ended questions were used to get a better understanding of Grade 11 students' perception of Scratch after programming in Java.

Data collection

After receiving ethical approval from the University of KwaZulu-Natal, the questionnaire, along with an accompanying letter of consent, was manually issued to respondents. Letters of consent were also issued to parents/guardians, due to the fact that all respondents were below the age of 18. Consent letters were signed by research participants and also by participants' parents. Respondents were also made aware that the data received from them would be anonymous.

Data analysis

To ensure reliability of data, Cronbach's alpha was calculated among the Likert scale questions of the questionnaire. Cronbach's alpha is a measure of internal consistency, used to determine how closely related a collection of values are as a group. A Spearman correlation coefficient was used to measure the strength and direction between the four constructs of the technology acceptance model. Spearman correlation was chosen since the quantitative data obtained were nominal (ranked on a Likert scale) and not normally distributed (Chok, 2010). Also, the Mann-Whitney test was used to determine if there were significant differences in perceptions between Grade 10 and Grade 11 students.

4. Findings and discussion

The quantitative data and qualitative data obtained from the questionnaire were analysed to identify and explore the relationships between four variables in respect of use of Scratch—perceived usefulness (U), perceived ease of use (E), attitude towards using (A), and behavioral intention to use (BI)—as specified by TAM.

An initial target size of 70 was planned for the study. Ultimately 47 surveys were returned, and 45 could be analysed. The 45 respondents consisted of 23 Grade 10 students and 22 Grade 11 students, which amounted to 64% of the total population. (Two of the completed questionnaires were deemed unusable for the study as many questions were unanswered.) Descriptive statistical analysis and correlation analysis techniques were utilised to analyse percentages and frequencies of the Likert scale questions in the questionnaire. Reliability analysis was used to measure reliability of the data.

Reliability analysis

As stated above, to test reliability of the data, Cronbach's alpha was calculated among the Likert scale questions of the questionnaire. The questions were grouped into four constructs of TAM, namely U, E, A and BI. A reliability coefficient of 0.7 or higher is generally considered acceptable (Tavakol & Dennick, 2011). The results for all four groups of questions showed values greater than 0.7, indicating that with all four groups, the items within the group had acceptable levels of consistency. The 10 questions within the U factor obtained an alpha coefficient of 0.751. The five questions within the E factor obtained an alpha coefficient of 0.801. The four

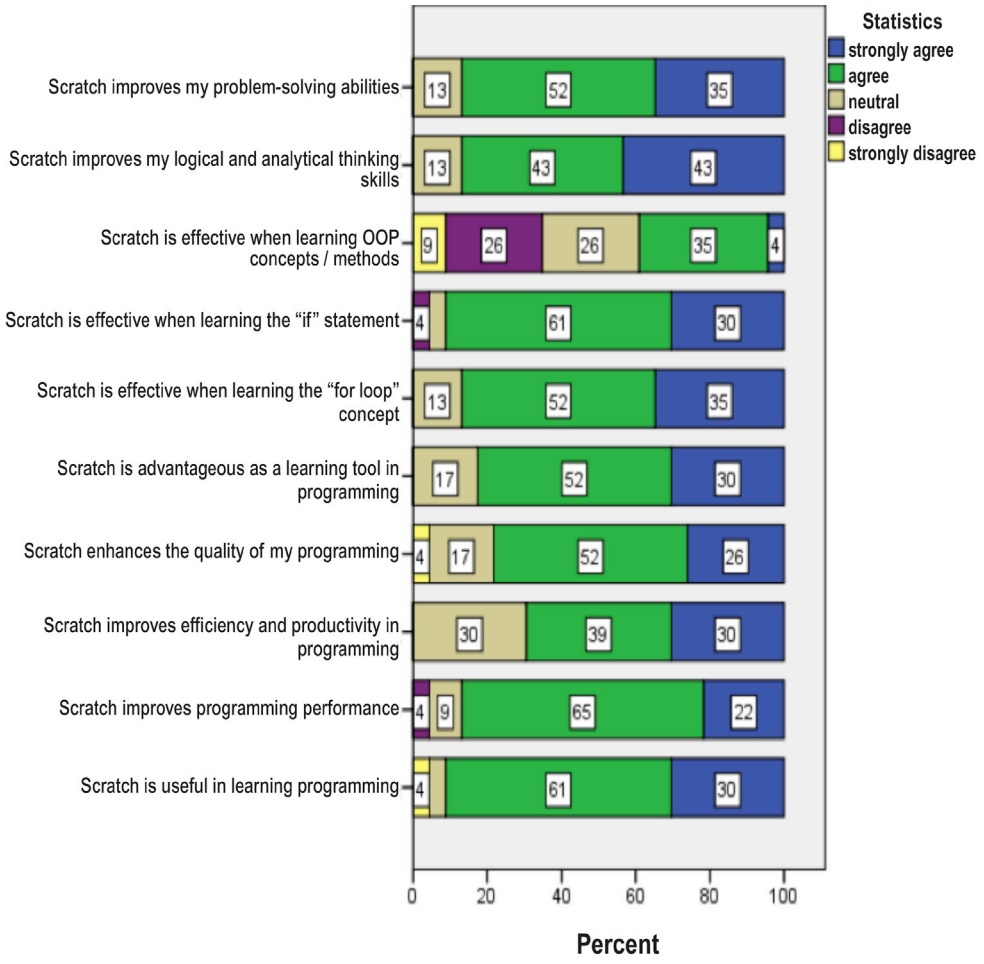
questions within the A factor obtained an alpha coefficient of 0.864. The three questions within the BI factor obtained an alpha coefficient of 0.867.

Descriptive statistical analysis

Perceived usefulness

Figures 2 and 3 illustrate the descriptive statistical findings for perceived usefulness of Scratch.

Figure 2: Perceived usefulness of Scratch among Grade 10 respondents



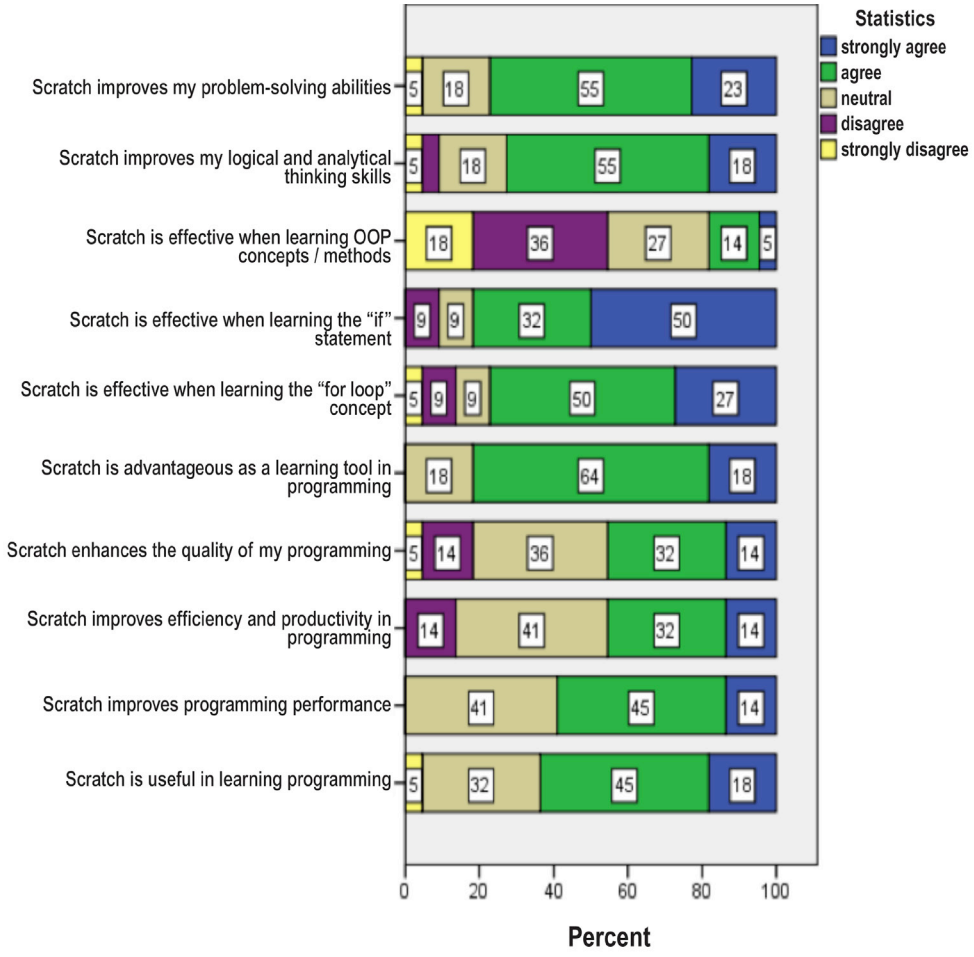
As shown in Figure 2, the statement "Scratch is effective when learning OOP concepts/methods" had a nearly equal percentage of negative and positive responses among the Grade 10 respondents. (OOP, alluded to earlier, is object-oriented programming, in which objects have attributes that are assigned data and these attributes can be manipulated.) For all the other factors, the majority of the Grade 10 respondents agreed or strongly agreed. Of these statements, "Scratch improves efficiency and productivity in programming" received agreement or strong agreement from 69% of the respondents, while the percentage of those who agreed or strongly agreed ranged from 82% to 91% for the remaining statements.

As shown in Figure 3, Grade 11 students perceived the usefulness of Scratch positively in terms of all statements except the statement "Scratch is effective when learning OOP concepts/methods." There was majority neutrality or disagreement in response to this statement among Grade 11 students (27% were neutral, 54% disagreed or strongly disagreed). This was presumably due to Grade 11 students having being exposed to OOP concepts in the Java programming environment and therefore seeing the Scratch programming environment as inferior in terms of learning OOP.

The positive responses were sharply lower among Grade 11 students than among Grade 10 students for the following factors: "Scratch is useful in learning programming", and "Scratch improves programming performance." Thus, it became apparent that after students had been exposed to the highly syntax-based environment of Java, they tended to feel that Scratch was not useful in learning programming and or improving their programming performance.

Both groups of students had similar percentages of positive responses for the factors "Scratch improves my logical and analytical thinking skills" and "Scratch improves my problem-solving abilities." Thus, even after exposure to Java, the Grade 11 students still positively perceived Scratch's ability to improve their logical/analytical thinking skills and problem-solving abilities.

Figure 3: Perceived usefulness of Scratch among Grade 11 respondents



Perceived ease of use

Figures 4 and 5 illustrate the descriptive statistical findings for perceived ease of use of Scratch.

Figure 4: Perceived ease of use of Scratch among Grade 10 respondents

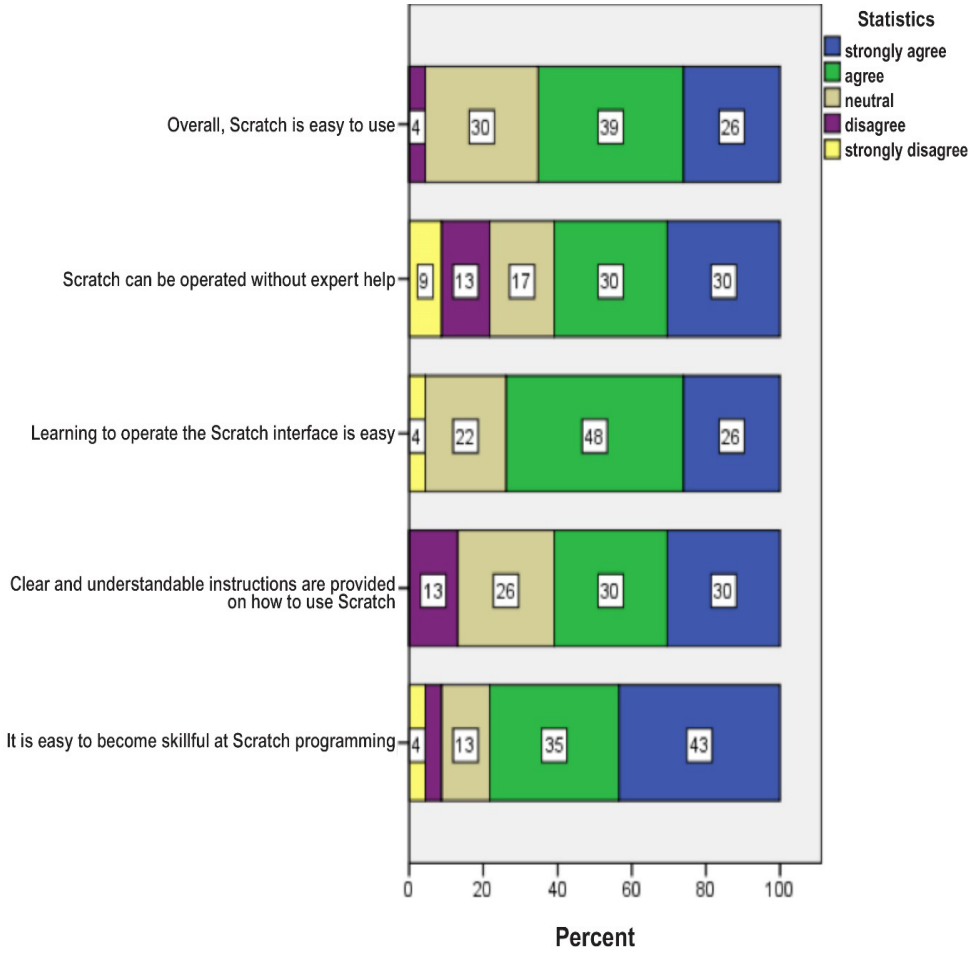
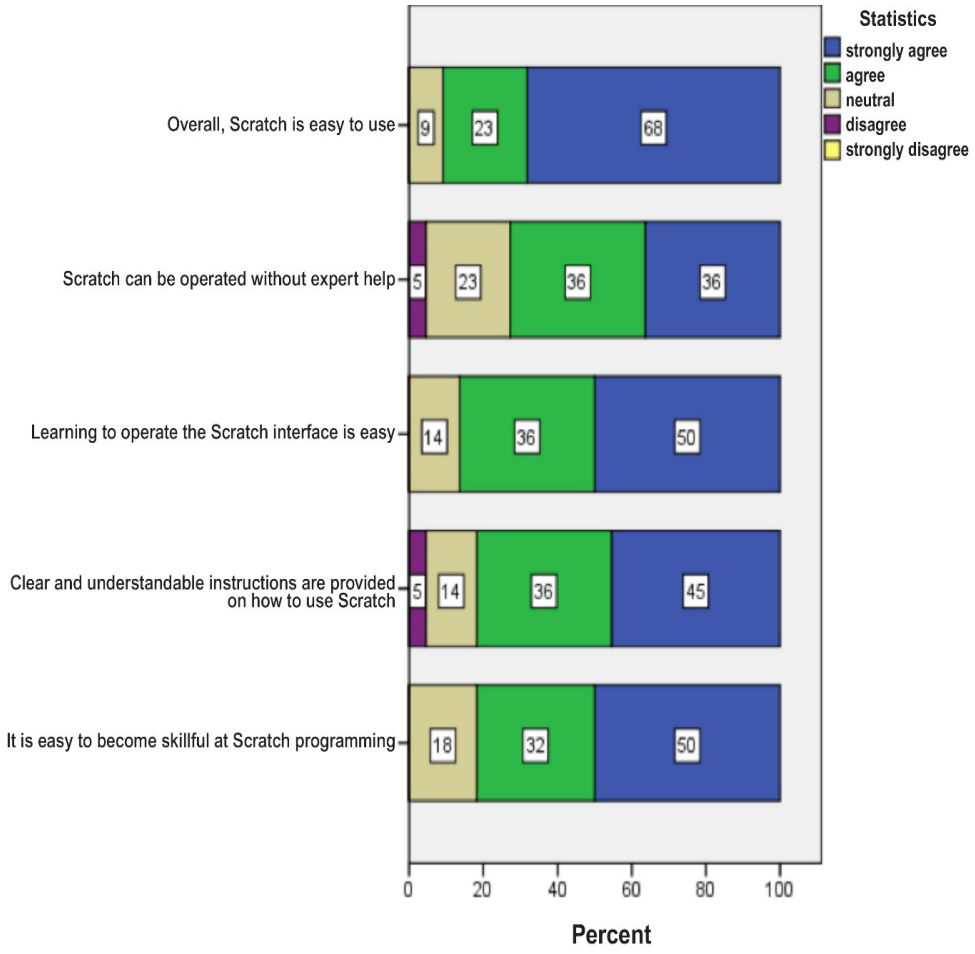


Figure 5: Perceived ease of use of Scratch among Grade 11 respondents

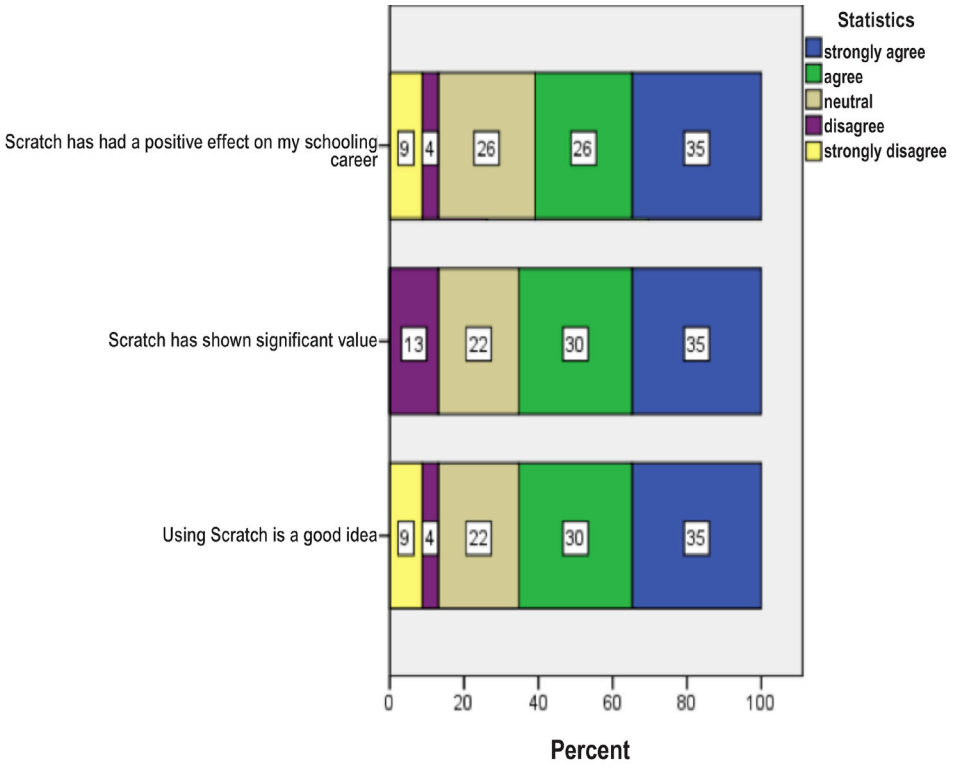


As seen in Figures in 4 and 5, both the Grade 10 and Grade 11 students were found to have mostly positive perceptions (strongly agree or agree) in respect of the ease of use construct, thus indicating that most students found Scratch easy to use. When the two groups of responses are compared, one sees a greater percentage of positive responses from Grade 11 students than Grade 10 students in respect of ease of use. This difference was not unexpected, as the Grade 10 students were being exposed to programming for the first time, and thus it made sense that would find Scratch difficult to use. Meanwhile, the Grade 11 students had now been exposed to the Java programming environment, and could be expected to find the Scratch environment comparatively easy, thus contributing to greater number of positive responses from Grade 11 students compared to the Grade 10 learners.

Attitude towards using

Figures 6 and 7 illustrate descriptive statistical findings for respondents' attitude towards using Scratch.

Figure 6: Attitude towards using Scratch among Grade 10 respondents

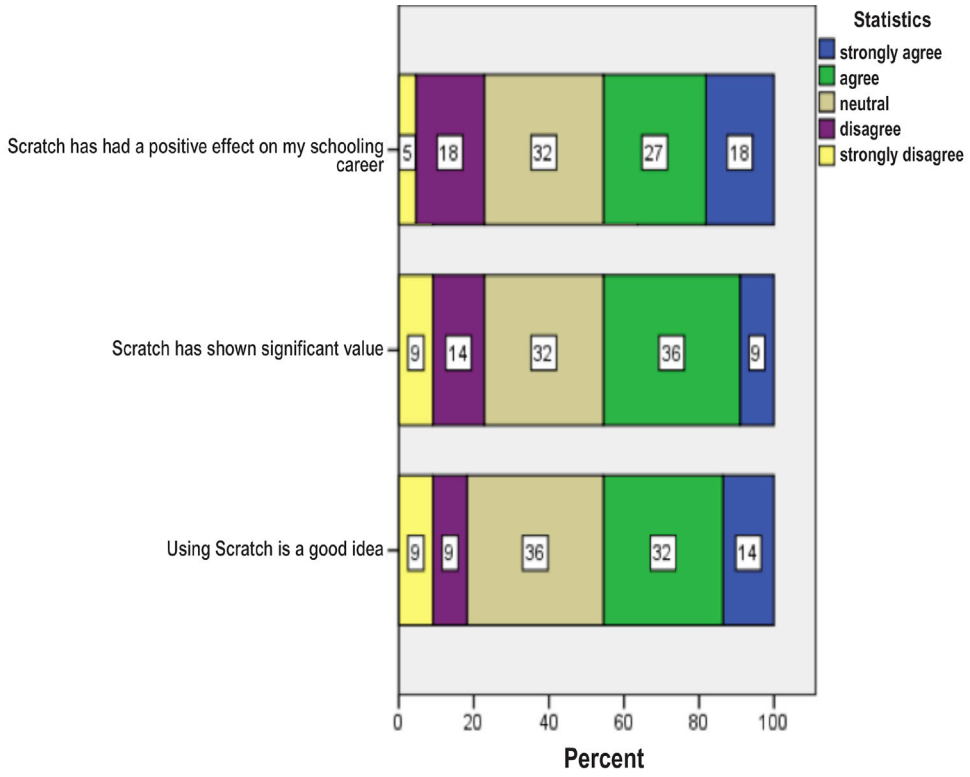


As Figure 6 shows, the majority of Grade 10 students were favourable in their attitude towards using Scratch. Their total positive responses (either agree or strongly agree) ranged from 61% to 65%.

Meanwhile, as seen in Figure 7, for Grade 11 students, favourable responses (strongly agree or agree) were never in the majority, with the three statements receiving fewer than 50% favourable responses, i.e., "Using Scratch is a good idea" (46%), "Scratch

has shown significant value" (45%), "Scratch has had a positive effect in my schooling career" (45%). These findings were apparently a result of Grade 11 students' exposure to Java, which made them able to identify the limitations of Scratch.

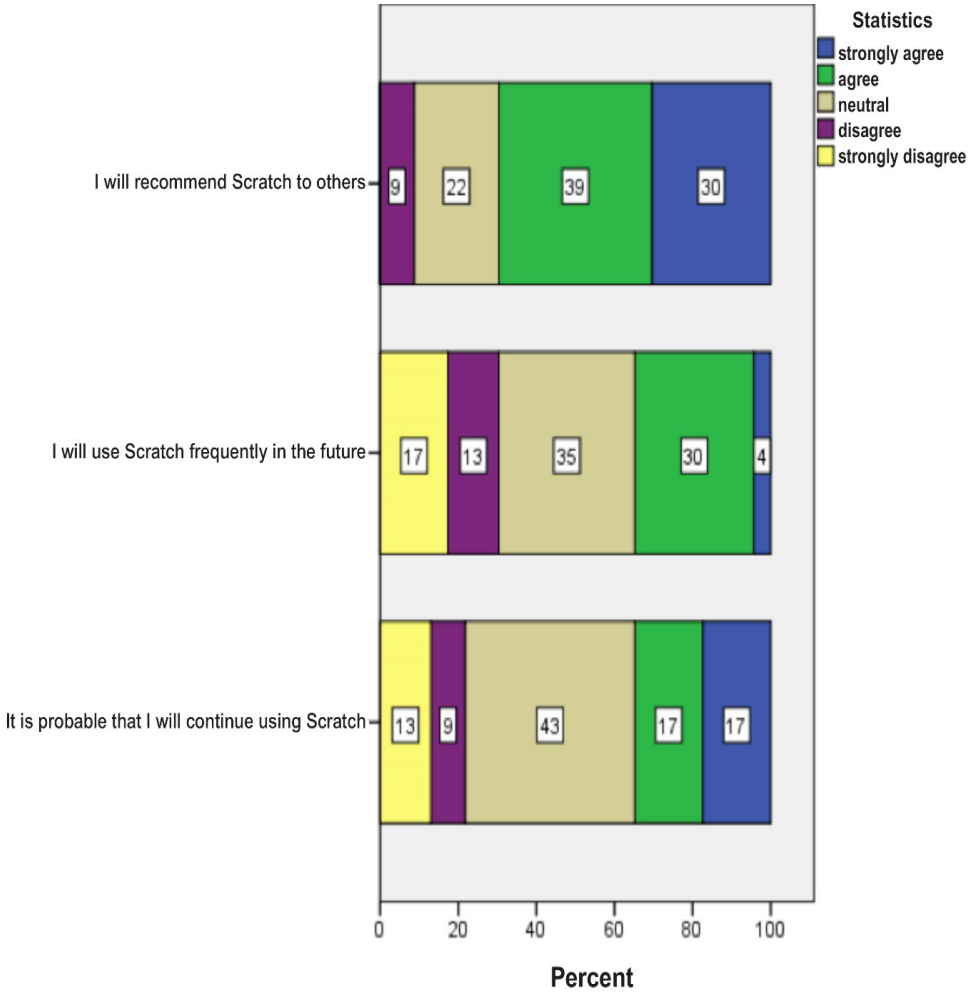
Figure 7: Attitude towards using Scratch among Grade 11 respondents



Behavioural intention to use

Figures 8 and 9 illustrate the descriptive statistical findings for respondents' behavioural intention to use Scratch.

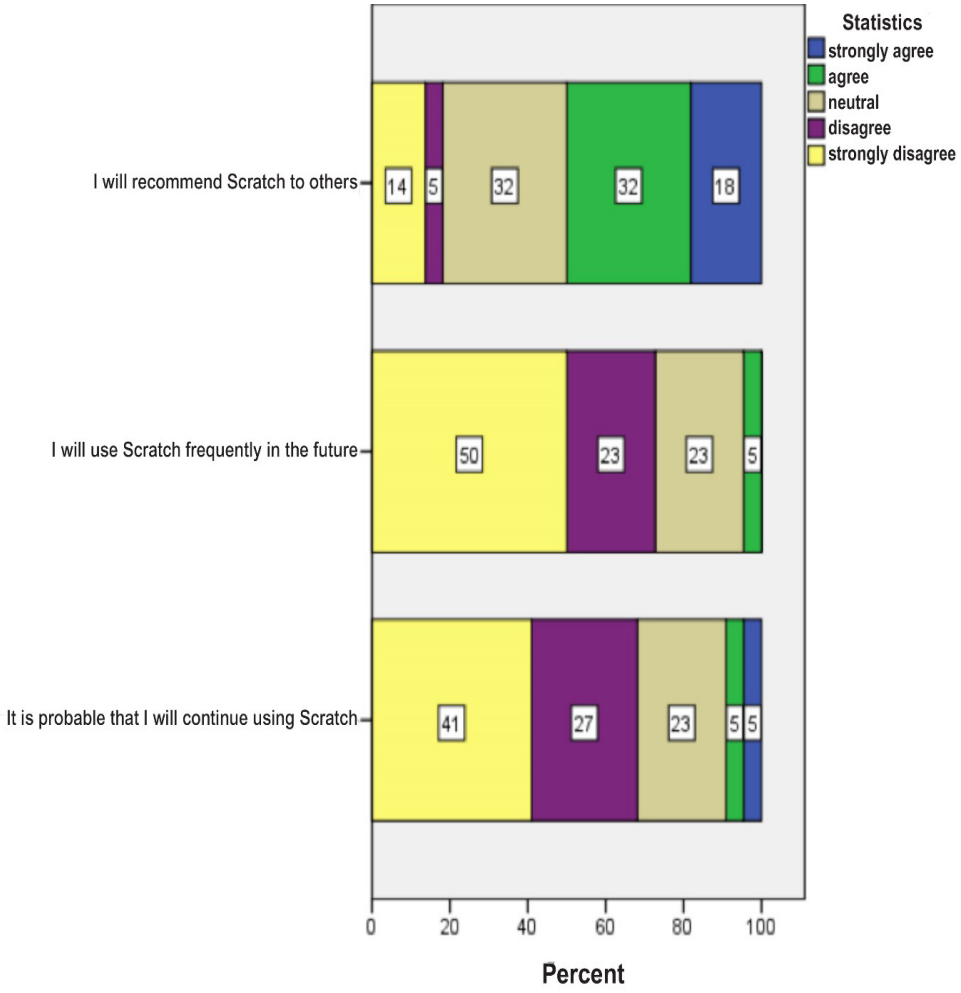
Figure 8: Behavioural intention to use Scratch among Grade 10 respondents



As seen in Figure 8, among the Grade 10 students, 69% of respondents either agreed or strongly agreed that they would recommend Scratch to others. However, there were much less favourable responses to the statements "I will use Scratch frequently in the future" (only 34% agreed or strongly agreed) and "It is probable that I will continue using Scratch" (only 34% agreed or strongly agreed).

Meanwhile, for Grade 11 respondents, as shown in Figure 9, 50% agreed or strongly agreed that they would recommend Scratch to others. But for the other two statements, the majority of respondents disagreed or strongly disagreed, i.e., the statements "I will use Scratch frequently in the future" (73% disagreed or strongly disagreed) and "It is probable that I will continue using Scratch" (68% disagreed or strongly disagreed). Thus, this suggests that after exposure to Java, the Grade 11 students had become aware of the limitations in the capabilities of Scratch and, accordingly, perceived that they did not intend to use it going forward.

Figure 9: Behavioural intention to use Scratch among Grade 11 respondents



Mann-Whitney test

Since the data were not normally distributed, a Mann-Whitney test was performed to determine if there were significant differences in perception between Grade 10 and Grade 11 students with regard to the TAM factors.

Table 1: Mean values for TAM constructs, Grades 10 and 11

TAM Factor	Grade	N	Mean	Std. Deviation	Std. Error Mean
U	Grade 10 Grade 11	23 22	1.9826 2.3455	.44889 .47180	.09360 .10059
E	Grade 10 Grade 11	23 22	2.1478 1.6909	.74399 .61945	.15513 .13207
A	Grade 10 Grade 11	23 22	2.2609 2.7159	1.09357 .87728	.22803 .18704
BI	Grade 10 Grade 11	23 22	2.6667 3.5909	1.01504 .94243	.21165 .20093

As seen in Table 1, the mean values for constructs were calculated separately for Grades 10 and 11. The results show that the mean value for all questions describing the perceived usefulness of Scratch (U) was 1.98 and 2.34, respectively, for Grades 10 and 11. Both these values were below the midpoint (3), indicating a generally positive response. There was a statistically significant difference of perceived usefulness between the two grades (chi-square = 8.175, p = 0.004), with a mean rank of 17.56 for Grade 10 and 28.70 for Grade 11. Thus, Grade 10 students were more positive than Grade 11 students, to a statistically significant extent, towards the perceived usefulness of Scratch.

For perceived ease of use (E), the mean values for Grade 10 and 11 were 2.14 and 1.69 respectively. Both these values were below the midpoint (3), indicating a generally positive response. But there was no statistically significant difference of perceived ease of use between the two grades (chi-square = 3.679, p = 0.055), with a mean rank of 26.65 for Grade 10 and 19.18 for Grade 11.

The mean value for questions related to students' attitude towards using Scratch (A) was 2.2 for Grade 10, indicating a generally positive response. Meanwhile, the mean value for attitude for Grade 11 respondents was 2.71, indicating a generally positive (but not strongly positive) response. There was no statistically significant difference in attitude between the two grades (chi-square = 3.333, p = 0.068), with a mean rank of 19.52 for Grade 10 and 26.64 for Grade 11.

The mean value for questions related to students' behavioural intention to use Scratch (BI) was 2.66 for Grade 10, indicating a generally positive (but not strongly positive) response, while Grade 11 produced a mean value of 3.5, indicating a generally negative (but not strongly negative) response. There was a statistically significant difference in behavioural intention between the two grades (chi-square = 8.040, p = 0.005), with a mean rank of 17.61 for Grade 10 and 28.64 for Grade 11. These results show that the Grade 11 students, who had had experience with both Java and Scratch, had a more negative response, compared to the Grade 10 students, to perceived usefulness of Scratch and behavioural intention to use Scratch. Results from the open-ended questions were analysed to assess these phenomena.

Seventeen of the 22 Grade 11 students reported that they would have rather studied Java than Scratch in Grade 10. Respondent 5 from Grade 11 stated that "Java is a better programming language in general as it is more accurate and meticulous. Scratch is fairly simple and doesn't really contribute to learning programming skills well." Respondents 6 indicated that with Scratch "you didn't need to learn any coding". Respondents 7 said that "Scratch is more child-friendly". Respondent 10 described Scratch as "too junior", stating that it did not provide them with the sufficient level of programming knowledge they required for Java in Grade 11.

Correlation analysis

A Spearman rank correlation coefficient was used to measure the strength and direction between the four TAM constructs. Scores from the Likert scale questions ranged from 1 (strongly agree) to 5 (strongly disagree). The overall mean scores for each construct were calculated and are presented in Table 2.

Table 2: Correlation coefficients: Grade 10 respondents

Construct	Spearman correlation coefficients	Significance (2-tailed)
U – BI	0.539**	0.008
E – BI	0.291	0.178
A – BI	0.701**	0.000

**Correlation is significant at the 0.01 level (2-tailed)

The results (Table 2) show there was a moderately positive association (0.539) between Grade 10 students' beliefs that they found Scratch to be useful (U) and their intention to use it (BI). This statistically significant (p=0.008) association indicates that perceived usefulness generally did influence students' behavioural intention to use the Scratch programming language.

There was a strongly positive association (0.701) between the Grade 10 students' attitude towards using Scratch (A) and their behavioural intention to use it (BI).

This statistically significant (p=0.000) association indicates that students' attitudes towards Scratch programming did significantly influence their behavioural intention to use it. However, the Grade 10 respondents' beliefs about Scratch's ease of use (E) did not correlate significantly (r=-0.058, p=0.703) with students' behavioural intention to use it (BI). This means that the there was almost no linear association between how easy the Grade 10 students found Scratch to use and their behavioural intention to use it, indicating that perceived ease of use did not appear to influence behavioural intention.

Table 3: Correlation coefficients: Grade 11 respondents

Construct	Spearman correlation coefficients	Sigificance (2-tailed)
U – BI	-0.058	0.703
E – BI	-0.225	0.315
A – BI	0.743**	0.000

**Correlation is significant at the 0.01 level (2-tailed)

Table 3 presents the correlation coefficients for Grade 11 students. Unlike with Grade 10 students, perceived usefulness of Scratch (U) did not correlate significantly (r=-0.058, p=0.703) with Grade 11 students' behavioural intention to use it (BI). This means that the there was almost no linear association between how useful Grade 11 students found Scratch and their intention to use it, indicating that perceived usefulness did not appear to influence behavioural intention. This is presumably attributable to the Grade 11 students' experience with more advanced programming languages.

There was a strongly positive association (0.743) between Grade 11 respondents' attitude towards using Scratch (A) and their behavioural intention to use it (BI). This statistically significant (p=0.000) association indicates that Grade 11 students' attitude towards Scratch programming appeared to significantly influence their intention to use it.

Meanwhile, the Grade 11 students' beliefs about Scratch's ease of use (E) did not correlate significantly (r=-0.225, p=0.315) with their behavioural intention to use it (BI). This means that there was almost no linear association between how easy the Grade 11 respondents found Scratch to use and their intention to use it, indicating that perceived ease of use did not appear to influence Grade 11 students' behavioural intentions.

5. Conclusions and recommendations

This study aimed to identify how Scratch programming has been accepted by South African students, by exploring the associations between perceived usefulness,

perceived ease of use, attitude towards using, and behavioural intention to use—the four factors specified by TAM. This study thus seeks to make a contribution to the literature on Scratch programming, and on its effects in South African schooling since its introduction in 2011. Findings from the study suggest that perceived usefulness and attitude towards using were both significant factors in influencing student respondents' (in both Grade 10 and 11) behavioural intention to use Scratch. The findings also showed that perceived ease of use did not significantly influence, among both Grade 10 and 11 respondents, behavioural intention to use Scratch.

When data from both the closed-ended (quantitative) and open-ended (qualitative) survey questions were considered together, it became clear that Grade 11 students showed a more negative response than Grade 10 students to Scratch's usefulness. Data derived from the survey questionnaire's open-ended questions provided indications that Grade 11 respondents' unfavourable view of Scratch's usefulness was attributable to the fact that, unlike Grade 10 students who had only had experience with Scratch, the Grade 11 students had also been exposed to Java and many had come to the belief that Scratch did not provide the required knowledge, both syntactic and computational, required for Java.

Thus, the overall findings suggest that while Scratch helps students understand logic and problem-solving, it does not, according to the Grade 11 respondents, assist sufficiently in preparing students for using a higher-level programming language such as Java. The findings showed that although Grade 11 students perceived Scratch to be useful, they found it did not prepare them for "real programming", with the majority of Grade 11 students stating that it would have been better to study Java, instead of Scratch, in Grade 10. The transition from Scratch to Java was found, therefore, to involve too large a gap, leading to students perhaps losing interest in programming and perhaps leading to them eventually changing to another subject. Koorsse et al. (2015) have found that due to South African students finding programming difficult, many students change to an easier subject in Grade 12, or remain attempting the subject while lacking motivation and interest.

Accordingly, our recommendation, based on the findings of this study, is that another programming language, such as Visual Basic or Delphi, be introduced after exposure to Scratch, before students move on to Java. This would serve as a sufficient intermediary platform, to bridge the complexity gap between Scratch and Java. This would also assist in the gradual development of programming skills, allowing for greater understanding that would increase satisfaction in these subjects for students. Another result would be increased readiness and throughput of students who want to pursue subjects in the computing discipline at tertiary level, hence assisting in addressing the skills shortage faced by the South African IT sector.

Since Scratch has been found to develop both logical and problem-solving skills in this and other studies (Calao et al., 2015; Kalelioğlu & Gülbahar, 2014; Lai & Yang, 2011; Calder, 2010), it would also be beneficial to introduce this programming language much earlier in the schooling careers of South African students than in Grade 10, thus potentially implicitly assisting students to acquire better understanding of subjects that require problem-solving and logical thinking.

It must be noted that this study had limitations, due to its small sample size. The initial targeted sample size was 70, but it had to be reduced to 45 students because respondent students switched to another subject during the course of the year or did not appropriately complete the questionnaire. A more in-depth study could be carried out, including more students and more schools, thereby resulting in a larger sample size which would allow for better generalisability of findings.

In conclusion, this study provides insight into the perceptions of Scratch programming by students in two South Africa high schools, by highlighting factors that promote and inhibit its adoption by students. The results of this study could be considered by South African education policymakers and curriculum developers, to help inform policies and curriculum aimed at the following goals: increasing the retention rate of students in programming subjects; and providing students with the necessary skills to succeed in their tertiary education, and in industry. Successful realisation of these goals can assist in building South African programming capacity and capabilities, addressing the shortage of programming skills in the country, and decreasing the country's reliance on offshore-outsourcing of these skills.

References

Annamalai, S., & Salam, S. N. A. (2017). Facilitating programming comprehension for novice learners with multimedia approach: A preliminary investigation. In American Institute of Physics (AIP) (Ed.), *AIP conference proceedings 1891*. https://doi.org/10.1063/1.5005362

Baytak, A., & Land, S. (2011). An investigation of the artifacts and process of constructing computers games about environmental science in a fifth grade classroom. *Educational Technology Research and Development, 59*(7), 765–782. https://doi.org/10.1007/s11423-010-9184-z

Beyers, R. N., & Van der Merwe, L. (2017). Initiating a pipeline for the computer industry: Using Scratch and LEGO robotics. In IEEE (Ed.), *2017 Conference on Information Communications Technology and Society (ICTAS): Proceedings*. Umhlanga, Durban, 8–10 March. https://doi.org/10.1109/ictas.2017.7920646

Bosse, Y., & Gerosa, M. A. (2017). Why is programming so difficult to learn? Patterns of difficulties related to programming learning. *ACM SIGSOFT Software Engineering Notes, 41*(6), 1–6. https://doi.org/10.1145/3011286.3011301

Boyle, T., Bradley, C., Chalk, P., Jones, R., & Pickard, P. (2003). Using blended learning to improve student success rates in learning to program. *Journal of Educational Media (Special Edition on Blended Learning), 28*(2), 165–178. https://doi.org/10.1080/1358165032000153160

Cakir, R., & Solak, E. (2014). Exploring the factors influencing e-learning of Turkish EFL learners through TAM. *The Turkish Online Journal of Educational Technology*, *13*(3), 79–87. https://doi.org/10.1016/j.sbspro.2015.01.515

Calao, L. A., Moreno-León , J., Correa, H. E., & Robles, G. (2015). Developing mathematical thinking with Scratch: An experiment with 6th Grade students. In G. Conole, T. Klobučar, C. Rensing, J. Konert, & E. Lavoué (Eds.), *Proceedings of 10th European Conference on Technology Enhanced Learning (EC-TEL 2015)*, Toledo, Spain, September 15-18 (pp. 17–25).

Calder, N. (2010). Using Scratch: An integrated problem-solving approach to mathematical thinking. *Australian Primary Mathematics Classroom, 15*(4), 9–14.

Chetty, J., & Barlow-Jones., G. (2012). Integrating teaching-and-learning techniques for novice computer programming students. In Advancement of Computing in Education (AACE) (Ed.), *Proceedings of Global Learn 2012: Global Conference on Learning and Technology* (pp. 142-146). Retrieved from https://www.learntechlib.org/primary/p/42056

Chok, N. S. (2010). Pearson's versus Spearman's and Kendall's coefficients for continuous data. Retrieved from http://d-scholarship.pitt.edu/8056/1/Chokns_etd2010.pdf

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. https://doi.org/10.1287/mnsc.35.8.982

Department of Basic Education. (2011). Curriculum and Assessment Policy Statement (CAPS). Pretoria: Government of South Africa.

Ebrahimi, A., Geranzeli, S., & Shokouhi, T. (2013). Programming for children: "Alice and Scratch analysis". Paper presented to the 3rd International Conference on Emerging Trends of Computer and Information Technology (ICETCIT), Singapore, 6–7 November.

Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, *13*(1), 93–106.

Fessakis, G., Gouli, E., & Mavroudi, E. (2013). Problem solving by 5–6 years old kindergarten children in a computer programming environment: A case study. *Computers & Education, 63*, 87–97. https://doi.org/10.1016/j.compedu.2012.11.016

Housand, B. C., & Housand, A. M. (2011). Plugging into creative outlets. *Gifted Education Communicator*, *42*(1), 20–23.

Ibrahim, R., Leng, N. S., Yusoff, R. C. M., Samy, G. N., Masrom, S., & Rizman, Z. I. (2017). E-learning acceptance based on technology acceptance model (TAM). *Journal of Fundamental and Applied Sciences, 9*(4S), 871–889.

Isa, N. A. M., & Derus, S. R. M. (2017). Students experience in learning fundamental programming: An analysis by gender perception. *Advanced Journal of Technical and Vocational Education, 1*(1), 240–248.

Iskrenovic-Momcilovic, O. (2017). Choice of visual programming language for learning programming. *International Journal of Computers, 2*, 250–254.

Kalelioglu, F., & Gulbahar, Y. (2014). The effects of teaching programming via Scratch on problem solving skills: A discussion from learners' perspective. *Informatics in Education, 13*(1), 33–50.

Kim, H., Choi, H., Han, J., & So, H. (2011). Enhancing teachers' ICT capacity for the 21st century learning environment: Three cases of teacher education in Korea. *Australasian Journal of Educational Technology (AJET), 28*, 965–982. https://doi.org/10.14742/ajet.805

Koorsse, M., Cilliers, C., & Calitz, A. (2015). Programming assistance tools to support the learning of IT programming in South African secondary schools. *Computers and Education*, *82*, 162–178. https://doi.org/10.1016/j.compedu.2014.11.020

Lai, A.-F., & Yang, S.-M. (2011). The learning effect of visualized programming learning on 6th graders' problem solving and logical reasoning abilities. In IEEE (Ed.), *2011 International Conference on Electrical and Control Engineering (ICECE),* Yichang, China, 16-18 September (pp. 6940–6944). https://doi.org/10.1109/iceceng.2011.6056908

Lamb, A., & Johnson, L. (2011). Scratch: Computer programming for 21st century learners. *Teacher Librarian, 38*(4), 64–68.

Lee, Y. J. (2011). Scratch: Multimedia programming environment for young gifted learners. *Gifted Child Today, 34*(2), 26–31. https://doi.org/10.1177/107621751103400208

Lewis, C. M. (2010). How programming environment shapes perception, learning and goals: Logo vs. Scratch. *SIGCSE'10* Retrieved from http://ims.mii.lt/ims/konferenciju_medziaga/SIGCSE'10/docs/p346.pdf

Lye, S. Y., & Koh, J. H. L. (2014). Review on teaching and learning of computational thinking through programming: What is next for K-12? *Computers in Human Behavior, 41*, 51–61. https://doi.org/10.1016/j.chb.2014.09.012

Korkmaz, Ö. (2016). The effect of Scratch- and Lego Mindstorms Ev3-based programming activities on academic achievement, problem-solving skills and logical-mathematical thinking skills of students. *MOJES:Malaysian Online Journal of Educational Sciences, 4*(3), 73–88.

Malan, D. J., & Leitner, H. H. (2007). Scratch for budding computer scientists. Paper presented to SIGCSE'07, 7-10 March, Covington, KY. Retrieved from https://cs.harvard.edu/malan/publications/fp079-malan.pdf

Maloney, J., Resnick, M., Rusk, N., Silverman, B., & Eastmond, E. (2010). The Scratch programming environment. *ACM Transactions on Computing Education, 10*(4), 1–15. https://doi.org/10.1145/1868358.1868363

Mannila, L., Peltomäki, M., & Salakoski, T. (2006). What about a simple language? Analyzing the difficulties in learning to program. *Computer Science Education, 16*(3), 211–227. https://doi.org/10.1080/08993400600912384

Marques, O. F., & Marques, M. T. (2012). No problem? No research, little learning ... big problem! *Systemics, Cybernetics and Informatics, 10*(3), 60–62.

McCracken, M., Almstrum, V., Daiz, D., Guzdail, M., Hagan, D., Kolikant, Y. B., Laxer, C., Thomas, L., Utting, I., & Wilusz, T. (2001). A multi-national, multi-institutional study of assessment of programming skills of first-year CS students. Paper presented at the Working group reports from ITiCSE on Innovation and technology in computer science education, Canterbury, UK. https://doi.org/10.1145/572134.572137

Meerbaum-Salant, O., Armoni, M. & Ben-Ari, M. (2013). Learning computer science concepts with Scratch. *Computer Science Education, 23*(3), 239–264. https://doi.org/10.1080/08993408.2013.832022

Meyerovich, L., & Rabkin, A. (2013). Empirical analysis of programming language adoption. Retrieved from http://sns.cs.princeton.edu/docs/asr-oopsla13.pdf

Milne, I., & Rowe, G. (2002). Difficulties in learning and teaching programming—Views of students and tutors. *Education and Information Technologies, 7*(1), 55–66.

Moser, R. (1997). A fantasy adventure game as a learning environment: Why learning to program is so difficult and what can be done about it. In Special Interest Group on Computer Science Education (SIGCSE) (Ed.), *ITiCSE '97:Proceedings of the 2nd Conference on Integrating Technology into Computer Science Education* (pp. 114-116), Uppsala, Sweden, 1–5 June. https://doi.org/10.1145/268809.268853

Mugo, D. G., Njagi, K., Chemwei, B., & Motanya, J. O. (2017). The technology acceptance model (TAM) and its application to the utilization of mobile learning technologies. *British Journal of Mathematics & Computer Science, 20*(4), 1–8. https://doi.org/10.9734/bjmcs/2017/29015

Olivier, J. (2016). Blended learning in a first-year language class: Evaluating the acceptance of an interactive learning environment. *Journal of Literary Criticism, Comparative Linguistics and Literary Studies, 32*(2), 1–12. https://doi.org/10.4102/lit.v37i2.1288

Ozmen, B., & Altun, A. (2014). Undergraduate students' experiences in programming: Difficulties and obstacles. *Turkish Online Journal of Qualitative Inquiry, 5*(3), 9–27.

Papadopoulos, Y., & Tegos, S. (2012). Using microworlds to introduce programming to novices. In IEEE (Ed.), *Proceedings of the 2012 16th Panhellenic Conference on Informatics,* Piraeus, Greece, 5–7 October. https://doi.org/10.1109/pci.2012.18

Papert, S. (1980). *Mindstorms: children, computers, and powerful ideas*. New York: Basic Books.

Parsons, D., & Haden, P. (2007). Programming osmosis: Knowledge transfer from imperative to visual programming environments. In S. Mann, & N. Bridgeman (Eds.), *Proceedings of the Twentieth Annual NACCQ Conference,* Hamilton, New Zealand (pp. 209–215).

Pendergast, M. O. (2006). Teaching introductory programming to IS students: Java problems and pitfalls *Journal of Information Technology Education, 5*(1), 491–515. https://doi.org/10.28945/261

Permatasari, L., Yuana, R. A., & Maryono, D. (2018). Implementation of Scratch application to improve learning outcomes and student motivation on basic programming subjects. *Indonesian Journal of Informatics Education, 2*(2), 95–102.

Robins, A., Rountree, J., & Rountree, N. (2003). Learning and teaching programming: A review and discussion. *Computer Science Education, 13*(2), 137–172. https://doi.org/10.1076/csed.13.2.137.14200

Rudder, A., Bernard, M., & Mohammed, S. (2007). Teaching programming using visualization. In ACTA (Ed.), *Proceedings of the Sixth Conference on IASTED International Conference Web-Based Education - Volume 2* (pp. 487–492), Chamonix, France, 14-16 March.

Sáez-López, J. M., Román-González, M., & Vázquez-Cano, E. (2016). Visual programming languages integrated across the curriculum in elementary school: A two year case study using "Scratch" in five schools. *Computers & Education, 97*, 129–141. https://doi.org/10.1016/j.compedu.2016.03.003

Sanchez-Mena, A., Marti-Parreno, J., & Aldas-Manzano, J. (2017). The effect of age on teachers' intention to use educational video games: A TAM approach. *The Electronic Journal of e-Learning, 15*(4), 355–366.

Tan, P.-H., Ting, C.-Y., & Ling, S.-W. (2009). Learning difficulties in programming courses: Undergraduates' perspective and perception. In IEEE (Ed.), *ICCTD 2009: 2009 International Conference on Computer Technology and Development, Volume 2* (pp. 42–46). https://doi.org/10.1109/icctd.2009.188

Tavakol, M., & R. Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Theodorou, C., & Kordaki, M. (2010). Super Mario: A collaborative game for the learning of variables in programming. *International Journal of Academic Research, 2*(4), 111–118.

Tom, M. (2015). Five Cs Framework: A student-centered approach for teaching programming courses to students with diverse disciplinary background. *Journal of Learning Design, 8*(1), 21–37. https://doi.org/10.5204/jld.v8i1.193

Topalli, D., & Cagiltay, N. E. (2018). Improving programming skills in engineering education through problem-based game projects with Scratch. *Computers & Education, 120*, 64–74. https://doi.org/10.1016/j.compedu.2018.01.011

Van Zyl, S., Mentz, E., & Havenga, M. (2016). Lessons learned from teaching Scratch as an introduction to object-oriented programming in Delphi. *African Journal of Research in Mathematics, Science and Technology Education, 20*(2), 131–141. https://doi.org/10.1080/18117295.2016.1189215

Watters, A. (2011). Scratch: Teaching the difference between creating and remixing. Mind/Shift. Retrieved from http://ww2.kqed.org/mindshift/2011/08/11/scratch-teaching-kids-about-programming-teaching-kids-about-remixing/

Wilson, A., & Moffat, D. C. (2010). *Evaluating Scratch to introduce younger schoolchildren to programming*. School of Engineering and Computing, Glasgow Caledonian University, Glasgow. Retrieved from http://scratched.gse.harvard.edu/sites/default/files/wilson-moffat-ppig2010-final.pdf

Research Data Collection in Challenging Environments: Barriers to Studying the Performance of Zimbabwe's Parliamentary Constituency Information Centres (PCICs)

Isaiah Munyoro
Post-Doctoral Research Fellow, Department of Information Science, University of South Africa (UNISA), Pretoria; and Director of Library Services, Parliament of Zimbabwe, Harare

Abstract
This article describes and analyses data collection challenges encountered in the course of research into the performance of Zimbabwe's Parliamentary Constituency Information Centres (PCICs). During collection of data on the work of PCICs in various constituencies across the country, many of them rural, the following challenges were encountered: low response rates; unreliable road access; unsuitable physical locations of PCICs, including politicised locations; political and legal restrictions; time management and financial challenges; and religious and cultural barriers. The article concludes that researchers planning data collection in developing-world environments must be cognizant of the particular challenges these environments may pose, while at the same time contending with challenges that all researchers, in both developed and developing worlds, face, such as the need ensure strong connections with people based in the local environments in which data collection is to take place.

Keywords
research, data collection challenges, qualitative research, politics, law, culture, religion, developing world, Zimbabwe, Parliamentary Constituency Information Centres (PCICs)

DOI: https://doi.org/10.23962/10539/26111

Recommended citation
Munyoro, I. (2018). Research data collection in challenging environments: Barriers to studying the performance of Zimbabwe's Parliamentary Constituency Information Centres. *The African Journal of Information and Communication (AJIC), 21,* 81–95. https://doi.org/10.23962/10539/26111

This article is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence: http://creativecommons.org/licenses/by/4.0

1. Introduction

UNESCO (2009) has highlighted problems of research data collection due to cultural practices in certain settings. Many cultures are reserved, thereby militating against participation in research, even when the research has developmental objectives, while other cultures are open, providing researchers with information that can then potentially positively contribute to development. This article highlights some of the data collection challenges I faced as a researcher during data collection on the performance of Zimbabwe's Parliamentary Constituency Information Centres (PCICs).

In Zimbabwe, PCICs are, as their name suggests, entities that aim to provide information on the workings of Parliament. The reforms of the Parliament of Zimbabwe, which started in 1997 and continued into the 2000s, included a decision to reform its information services. PCICs were set up in all 120 of the constituencies that existed at the time of the Fifth Parliament, from 2000 to 2005. The idea behind the establishment of PCICs was twofold: to provide public access to Parliament-generated information; and to act as a platform for public participation in Parliament's activities.

The PCICs have faced numerous challenges, both operational and administrative, since their inception, and several evaluations and studies have been conducted in an effort to find ways of improving their operations (see, for example, De Vrieze & Murupa, 2012). De Vrieze and Murupa (2012), during their visits to collect data for evaluation of the operation of the PCICs, found that political partisanship was retarding public participation at the centres. They recommended education and awareness campaigns to improve PCIC operations. They also noted lack of clear understanding of the PCIC project's objectives, as implemented by the central government and development partners (De Vrieze & Murupa, 2012).

It was during my study of the PCICs that I encountered the particular set of data collection challenges that are the focus of this article. As is outlined below, two of the key problems faced in seeking to interact with constituents targeted by PCICs are also problems faced by the Centres themselves in their interactions with citizens. Constituents' lack of awareness of the functions of the PCICs, and their mistrust of the Centres due to their apparent political affiliations, is indeed a hindrance to researchers seeking to study the performance of the PCICs.

More fundamentally, these problems would appear to be undermining the ability of the PCICs to fulfil their important role as conduits between ordinary Zimbabweans and the workings of their elected MPs in the national Parliament. It would seem that there is, thus, a need to educate MPs and citizens on the roles of the PCICs, and to extensively market the PCIC project, so that both MPs and constituents are aware of, and support, the objectives of the initiative.

This article is not, however, focused on the performance of the PCICs, but, rather, on the difficulties encountered in seeking to collect research data on PCICs' performance.

2. Literature review

Research data collection challenges

It is widely accepted that researchers must make known the shortcomings and challenges experienced in their data collection (see Lutabingwa & Nethonzhe, 2006). Silverman (2007) warns that in political contexts, researchers must exercise caution when collecting data. Gill, Stewart, Treasure, and Chadwick (2008) focus on the need for researchers to secure free access to research sites. Bailey (2007) focuses on the need for researchers to be as free as possible from constraints when using qualitative research methods such as interviews and focus groups. (As is explained later, interviewing was made difficult when a PCIC was located in premises that had political associations, and focus groups could not be convened to collect data because of challenges posed by the Public Order and Security Act (POSA).)

Cole and Knowles (2001) focus on participants' literacy, and how the language of interview questions and survey instruments can have an impact on data collection. Participants' literacy may influence their understanding of questions in a data collection instrument, consequently impacting the data collection process. Analysing challenges faced by PhD students, Dearnley (2005) found that researchers encounter numerous obstacles. Peersman (2014) has also written about the time and financial costs associated with accessing remote areas.

For example, for my PCIC study, travelling long distances was required to collect data in rural constituents, and there were accommodation, transport and other related costs. Other data collection challenges that one can face include time limitations, and concern over being criticised regarding the significance, methods, or conclusions of one's research (Creswell, 2003; 2009). The qualitative research approach places pressure and scrutiny on the "the researcher's ability to systematically demonstrate transparency and accountability throughout the whole research process" (Davies & Hughes, 2014, p. 12).

Data collection challenges in the developing world

A number of studies have looked at the degree to which research in the developing world faces challenges that are more pronounced, or different, than for research in the developed world. According to Altshuld and Witkin (2000), challenges of data collection in developing countries include: lack of appreciation of the importance of data collection as an activity, mixed with a general cultural ethos of not sharing personal information with outsiders; remote and thinly populated areas, posing logistical as well as technical problems, e.g., for application of area sampling; infrastructural deficiencies, including poor transport networks, roads, and telecommunication networks; and lack of political and administrative support for autonomous research.

Bulmer and Warwick (1983) argue that in developing-world research contexts, data collection challenges are not necessarily unique, but rather the challenges are more prevalent and severe than in the developed world. Bulmer and Warwick found that in the US, for instance, the number of respondents who simply did not understand the survey was less than 1% of a total sample, while in rural areas of some developing countries the figure might be closer to 10% or 15%.

Reflecting on research data collection challenges in the Caribbean, Busby (2003) found a strong feeling in rural communities that they are different from urban communities, and that they have special qualities not found in the cities. Relationships in rural areas are seen as personal and enduring; unlimited and unspecified in their demands and imbued with a strong sense of loyalty not only to friends and relatives, but to the community and its members. Particularly in many smaller communities, there is a community conception of being part of "the extended family". During a study of South African parliamentary information services and the role of parliamentary libraries, Mostert (2004, p. 193) encountered a major problem of non-responsiveness from respondents.

Speaking from the perspective of an experienced developing-country researcher, Caballero of Johns Hopkins University takes the position that "in many cases, we are in a pre-cultural stage" (Caballero, quoted in NRC, 2014). Caballero argues that in many developing countries, a lack of resources and expertise results in weak research regulation and an increasing reliance on private-sector research support that does not comply with the same kinds of rigorous frameworks that most developed-world researchers are accustomed to (Caballero, paraphrased in NRC, 2014).

In almost all data collection matters, researchers in developing countries face different sets of problems as compared to researchers in developed-world contexts. Elahi (2008), in a study data collection problems in Pakistan's public institutions, identified both internal problems, such as organisational set-up, lack of resources and infrastructure or operational inadequacies, and external problems related to low literacy ratios and lack of awareness of the need for research among potential respondents. Such difficulties can be expected in most developing countries.

Data collection challenges in Zimbabwe

During the process of data collection in constituencies dominated by political party groups and religious apostolic followers in Zimbabwe, Machingura (2014) encountered resistance of political party membership from political subgroups, and from women and girls because their religious doctrine does not permit them to discuss issues with perceived strangers and researchers.

Feltoe and Maguranyanga (2015) found that data collection challenges in Zimbabwe are more pronounced in rural areas than in urban constituencies, where respondents

feel freer to volunteer information. Maguranya (2011) argues that data collection challenges in Zimbabwe's rural areas do not develop in a vacuum, but respond and transform in step with social, political and economic factors. Factors affecting access to rural and remote communities include underdeveloped infrastructure with physical topography, mountains, and poor roads creating difficulties for transportation (Magurunya, 2011). De Vrieze and Murapa (2012) point to the challenges posed by the variable standard and quality of communications in Zimbabwe, between different rural and remote areas and between those communities and the urban centres.

Researchers in Zimbabwe also have to contend with government legislation aimed at giving the state control over the gathering and dissemination of information. The Access to Information and Protection of Privacy Act (AIPPA) of 2002 is a legal instrument that enables the government to monitor and control the flow of information in the country. The AIPPA has exemptions that make it easy for the government of to refuse to release information on the grounds that such release would not be in the "public interest" (Republic of Zimbabwe, 2002b, sect. 9(4)).

The Public Order and Security Act (POSA) of 2002 seeks to curtail civil liberties and the freedoms of movement, expression and assembly (Republic of Zimbabwe, 2002a). For example, Part IV sets the procedure to be followed in order to be granted permission to hold public gatherings, whereby the organiser or organisers must notify the regulating authority of the intention to hold a public gathering (sect. 24). These POSA procedures and requirements can affect researchers' use of focus groups as data-gathering tools in public institutions.

3. The research

The aim of my data collection was to evaluate the performance of the PCICs. The key data generated pertained to why constituents visit PCICs, the PCICs' distance from constituents' homes, the PCICs' number of monthly visitors, the significance of PCICs' physical locations, and constituents' challenges in accessing parliamentary information from the PCICs.

All research ethical considerations were observed, and permission was granted to conduct the study by the Clerk of the Parliament of Zimbabwe. The study was based on theoretical assumptions of the interpretive paradigm, which is based on the notion that social reality is created and sustained through the subjective experience of people involved in communication (Creswell, 2003). This interpretive worldview suggests one can consider either a qualitative approach or an approach combining qualitative and quantitative methods (Mackenzie & Knipe, 2006).

My research into the PCICs combined qualitative and quantitative instruments. Qualitative research is carried out to enhance understanding of individuals' cultures, beliefs and values, human experiences and situations, as well as to develop theories

that describe these experiences (Holloway & Galvin, 2016). This research approach emerged from the behavioral and social sciences as a method of understanding the unique, dynamic, and holistic nature of human beings (Creswell, 2014).

The core target groups were PCIC office assistants (OAs), constituents, and Members of Parliament (MPs). These target groups were identified because they were thought to be appropriate in shedding light on the operation of PCICs in disseminating Parliamentary information to constituents.

PCIC OAs keep diaries of events for MP programmes, schedule meetings, and serve the public and visitors to the PCIC. Since they are locals, OAs have a good understanding of local communities and cultures. Constituents were also targeted as citizens residing in a legislative constituency who are the intended beneficiaries of parliamentary information. MPs were included in the study as they are the political leaders in constituencies and represent their respective constituents in Parliament. Data were also collected from the Parliamentary Programme Coordinator, the Clerk of Parliament, and some officers of Parliament.

A mixed-methods research approach (Ngulube, 2010) was used in this study because it allowed for convergent analysis of both quantitative and qualitative data as advised by Creswell (2009). Questionnaires, often accompanied by interviews/ discussions related to the questionnaire questions, were used to collect data from OAs, constituents, and MPs. The questionnaire was completed by 15 out of the 25 targeted OAs, 255 out of the 625 targeted constituents, and 20 out of the 25 targeted MPs. In-depth interviews were used to get data from the Parliamentary Programme Coordinator, the Clerk, and Parliamentary officers.

The study also used the direct observation method, as I made note of my own observations when I visited the PCICs. This allowed me to gain and document insights into elements such as constituents' behaviour at the PCICs, staff attitudes towards visiting constituents, the Centres' accessibility to constituents, the main activities taking place at the Centres, and the behaviours of survey and interview respondents. This method was used to complement the information gathered through the questionnaires and interviews.

Document analysis was also used, via scrutiny of OAs' reports, Parliamentary reports on its reform processes, and Parliamentary administration reports.

Having collected the data, quantitative data from questionnaires and interviews were analysed using the Statistical Package for the Social Sciences (SPSS), while qualitative data were analysed according via thematic codes. While questionnaires can provide evidence of patterns amongst large populations, qualitative interview data often gather more in-depth insights on participant attitudes, thoughts, and

actions (Harris & Brown, 2010). Mixed-methods research treats the paradigmatic differences between qualitative and quantitative methods as complementary, not incompatible (Day et al., 2008).

Purposive sampling was used to select the provinces during the first stage of selecting the sample. This decision was based on opinions about the districts which are typical or representative in some sense or context; for instance, most Mashonaland districts are typically dominated by Zimbabwe African National Union-Patriotic Front (ZANU-PF) supporters, while the metropolitan areas and Matabeleland Province are typically dominated by Movement for Democratic Change (MDC) supporters. Other districts are typically "swing" provinces, with a mix of ZANU-PF and MDC support and neither political party in strong-majority control.

The provinces were also stratified using other predominant characteristics, such as rural/urban and geographical population spread, and then a random sample of constituencies was selected in a variety of ways, chosen from each stratum in a proportionate way. Decisions on how many PCICs to sample in the selelectd provinces was based to some extent on the total number of registered voters in the province. The numbers of registered voters were obtained from the Zimbabwe Electoral Commission *Report on the Delimitation Exercise for the 2008 Harmonised Elections* (ZEC, 2008).

In determining the sample size for this study, I considered the availability of time and resources, and the extent of the need to provide valid and reliable data. As Denscombe reminds us (2003, p. 23), urban and rural populations often differ significantly from each other in many ways, such as types of employment, sources and amounts of income, and average household sizes.

The locations of of the 24 PCICs studied, which included a wide range of urban and rural settings, are shown in Table 1.

Table 1: Locations of PCICs studied

Province	PCIC location
Harare	1. Harare Central 2. Mt. Pleasant 3. Budiriro 4. Glen View South 5. Kambuzuma 6. Mbare 7. St. Mary's Chitungwiza
Masvingo	8. Gutu North 9. Gutu Central 10. Masvingo Urban 11. Bikita West 12. Mwenezi East
Mashonaland Central	13. Mazowe South 14. Mazowe West 15. Mt. Darwin West 16. Mt. Darwin South
Matabeleland South	17. Bulilima South 18. Bulilima 19. Umzingwane
Manicaland	20. Mutare Central 21. Makoni South 22. Mutasa South 23. Dangamvura-Chikanga 24. Headlands

4. Data collection challenges encountered

It must be emphasised that the findings presented in this article are ancillary to the main focus of the research data collection. The main focus of the research was linkages between the PCICs and their constituents. The focus here in this article is on the difficulties encountered while collecting data on the PCICs.

The data collection challenges faced can be grouped as follows:

- low PCIC office assistant (OA) response rate;
- low constituent response rate;
- unreliable road access;
- unsuitable physical locations of PCICs, including politicised locations;
- political and legal restrictions;

- time management and financial challenges; and
- religious and cultural barriers.

In the following sub-sections, each of these challenges is considered in turn.

Low PCIC office assistant (OA) response rate

As stated in Section 3 above, only 15 of the 25 OAs who received questionnaires responded: a 60% response rate. Masvingo, Mashonaland Central and Harare Provinces had four respondents each, amounting to provincial response-rates of 80%, 100% and 57% respectively, while Manicaland had two responses (for a response rate of 40%) and Matebeleland South had one response (a 33% response rate), as shown below in Table 2.

Table 2: OAs' questionnaire response rates by province

Province	No. of constituencies in the province	Response rate in the province (%)
Harare	7	57
Masvingo	5	80
Mashonaland Central	4	100
Matebeleland South	3	33
Manicaland	5	40

Selected OAs in some provinces had to get permission from the MP in order for them to respond, hence the low OA response rate could have been due to those OAs that did not get permission from the MP to respond.

Low constituent response rate

As stated in section 3 above, only 255 out of the 625 constituents who received questionnaires responded—a 40.8% response rate.

Table 3 shows the response-rate distribution in each of the five provinces where constituents were surveyed. Harare Province had 83 respondents, followed by Masvingo with 71, Mashonaland Central 48, Manicaland 42, and Matebeleland South 11.

Table 3: Constituents' questionnaire response rates by province (N=255)

Province	No. of responses	Response rate in the province (%)
Harare	83	32.5
Masvingo	71	27.8
Mashonaland Central	48	18.8
Matabeleland South	11	4.3
Manicaland	42	16.5

It was found, in collecting data from the people who did respond, that two of the key reasons for many constituents' reluctance to participate in the research were: (1) low levels of awareness of the objectives and functions of the PCICs, and (2) fear and mistrust of researchers. Where I did succeed in getting constituents to participate, it was often with the assistance of OAs.

Unreliable road access

It was found that a key barrier to accessing the PCICs was poor infrastructure. Visiting the rural and remote constituencies was a major challenge for the researcher. Most Zimbabwean rural areas' road networks are poor. Virtually impassable roads lead to what can be called "road bias". For example, in one remote constituency, progress was blocked by a damaged bridge.

The infrastructure barriers posed two key potential data collection problems. First, respondents in easily accessible areas do not provide an accurate representation of national realities including people in remote areas. Second, such respondents have had numerous contacts with researchers. They are a "convenient sample", so to speak, and hence are to some extent over-researched and, accordingly, tend to be sceptical or unfriendly towards researchers (as a result of false promises, or crises of expectations, emerging from interactions with previous researchers). Such respondents potentially undermine the reliability and validity of a study by providing superficial, insincere answers aimed at bringing the research interaction to a rapid conclusion.

Unsuitable physical locations of PCICs, including politicised locations

The physical locations of each PCIC studied had a direct bearing on my ability to collect data. Nearly half (47.4%) of the PCICs studied were located at local government premises, and the second-largest number (37%) were located on non-government, privately-owned premises. It was found that the PCICs located at privately-owned premises were mostly in constituencies loyal to the opposition MDC party—constituencies where, due to political conflict between the MDC and

the ruling ZANU-PF party at the time of the establishment of the PCICs, the PCIC for that constituency, which had an MDC MP, was not able to obtain office space at the local government premises (because of national control of most government premises by the ruling ZANU-PF).

The location of PCICs in private premises meant that I would have needed to seek data collection permission from the owner, regardless of the fact that permission had already been granted from Parliament to collect data at PCICs.

Other challenges posed by the physical locations of individual PCICs were as follows:

Harare Central PCIC – located at Trafalgar Court, this PCIC was not visible at all to constituents, although it was in the central business district (CBD) of the capital city Harare. The billboard for the Centre was badly placed, and directions to the office from outside the building could not be found. Very few constituents were managing to visit the PCIC, and this compromised the number of constituent respondents at this PCIC.

Headlands PCIC – this PCIC was moved from Headlands constituency to the town of Rusape, ostensibly because Headlands people could not locate it. However, the new location, at the MP's house, was not an improvement, because respondents conceived of it as a partisan space and did not feel comfortable going there for PCIC matters.

Mount Darwin South PCIC – this PCIC was located close to an office of the Zimbabwe National Liberation War Veterans Association, which is aligned to the ZANU-PF party, and the OAs working at this PCIC had been instructed to report "strangers", and their reasons for visiting, to the Association office. Accordingly, distribution of the research questionnaires, and discussions related to the questionnaires, were held in the presence of a War Veterans Association representative. This posed a significant challenge to my research, as the respondents were clearly not able to express themselves freely in such conditions.

Political and legal restrictions

Zimbabwe's aforementioned Public Order and Security Act (POSA) of 2002 impacted access to information during the research. POSA restricts public gatherings, so the constituents could not feel free and secure to hold meetings at PCICs, for fear of victimisation by law enforcement agents. Accordingly, I had to forego using focus groups, because this would have required obtaining police clearance, a difficult and onerous task. The research was thus forced to rely almost entirely on questionnaires to get the views of constituents.

Time management and financial challenges

In some constituencies, a second visit was required to collect completed questionnaires, due to delays in having them returned by OAs, constituents. and MPs. Many of these follow-up visits were caused by failure to meet MPs and OAs during the first appointments made with them, due in part to unreliable communication networks. Many of targeted MPs were, at the time of the research, participating in outreach activities linked to the new Constitution of 2013, making it difficult to get them to complete and submit the questionnaires. These second visits to constituencies, especially to remote ones, generated time management and financial challenges.

Work pressures also affected the time devoted to data collection, as there was need to balance my research with regular work activities.

Religious and cultural barriers

In some constituencies in Manicaland Province, respondents from Apostolic Church groups refused to complete questionnaires or be interviewed, and some women respondents in Manicaland refused to participate in the absence of their husbands. It became necessary to enlist the help of OAs to navigate these issues, as they were local people with strong linkages within the constituencies.

Another "cultural" barrier faced were the requests from some MPs to be financially compensated for their participation—even after explanation had been provided in detail about the purpose of the research and the MP in question had been shown the letter of consent for the research from the Clerk of the Parliament of Zimbabwe.

5. Conclusions

The data collection challenges outlined in this article, in the Zimbabwean context, provide lessons that can potentially be of value to other researchers working in developing-country contexts. Perhaps the most important lesson learned was that in order to carry out data collection successfully in rural Zimbabwe, the researcher has to have—or develop, or get access to via others—strong connections with people based in the local environments in which the data collection takes place.

In the case described in this article, it became necessary, in certain constituencies, to rely to a great extent on linkages possessed by the locally-embedded PCIC OAs. This lesson is, of course, not unique to rural, developing-world contexts. On-the ground connections are also undoubtedly essential for successful data collection in rural, developed-world contexts, and in urban contexts in both the developed and developing worlds. But as this article has demonstrated, the somewhat generic challenge of needing connections to the local people was exacerbated, during my research, by other challenges—e.g., unreliable roads, certain kinds of cultural barriers—that tend to be more pronounced in the developing world. And there were still other challenges—e.g., POSA restrictions on public gatherings, PCICs

housed in the homes of opposition party MPs, the Veterans Asssociation monitoring comings and goings at a PCIC—that were unique to Zimbabwe's particular set of political realities.

References

Altshuld, J., & Witkin, B. R. (2000). *Transferring needs into solution strategies*. Thousand Oaks, CA: Sage.

Bailey, C. A. (2007). *A guide to qualitative field research*. London: Sage. http://dx.doi.org/10.4135/9781412983204

Bulmer, M., & Warwick, D. P. (1983). *Social research in developing countries*. London: John Wiley and Sons.

Busby, L. A. (2003). General data challenges facing the Caribbean in the context of sustainable development. Paper presented at "Using information for decision making on sustainable development: Issues and challenges for Caribbean SIDS" seminar, Saint Lucia, 27–28 May.

Cole, A. L., & Knowles, J. G. (2001). *Lives in context: The art of life history research.* Oxford: Rowman and Littlefield.

Creswell, J. W. (2003). *Research design: Qualitative and quantitative approaches.* Thousand Oaks, CA: Sage.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage.

Davies, M. B., & Hughes, N. (2014). *Doing a successful research project: Using qualitative or quantitative methods.* London: Palgrave Macmillan.

Day, C., Sammons, P., & Gu, Q. (2008). Combining qualitative and quantitative methods in research on teachers' lives, work, and effectiveness: From integration to synergy. *Educational Researcher, 37*(6), 330–342.

Dearnley, C. (2005). A reflection on the use of semi-structured interviews. *Nurse Researcher, 13*(1), 19–28.

Denscombe, M. (2003). *The good research guide* (2nd ed.). Buckingham, UK: Open University Press.

De Vrieze, F., & Murapa, R. (2012). *Evaluation of the UNDP parliamentary support project in Zimbabwe and recommendations: Final evaluation report.* For the UN Development Programme.

Elahi, A. (2008). Challenges of data collection in developing countries – the Pakistani experience as a way forward. *Statistical Journal of the IAOS,* 25 (1,2), 11–17.

Feltoe, G., & Maguranyanga, B. (2015). *Where do religion and the law in Zimbabwe meet?* An analysis of apostolic religion, Doctrine and practices related to maternal and newborn child health in Zimbabwe. UNICEF. Retrieved from https://www.unicef.org/zimbabwe/Legal-Review-of-Apostolic-Religion

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, *204*, 291–295. https://doi.org/10.1038/bdj.2008.192

Harris, L. R., & Brown, G. T. L. (2010). Mixing interview and questionnaire methods: Practical problems in aligning data. *Practical Assessment, Research and Evaluation, 15*(1), 1–19. Retrieved from https://pareonline.net/pdf/v15n1.pdf

Holloway, I., & Galvin, K. (2016). *Qualitative research in nursing and healthcare*. London: John Wiley and Sons.

Hudson, P. (2007). *Parliamentary institutes*. Ostrava, Czech Republic: University of Ostrava.

Lutabingwa, J., & Nethonzhe, T. (2006). Ethical issues in social research. *Journal of Public Administration*, *41*, 694–702.

Machingura, F. (2014). The martyring of people over radical beliefs: A critical look at the Johane Marange Apostolic Church's perception of education and health. In E. Chitando, M. R. Gunda, & J. Kugler, J. (Eds.), *Multiplying in the spirit: African initiated churches in Zimbabwe* (pp. 175-198). Bamberg, Germany: University of Bamberg Press.

Maguranya, B. (2011). *Apostolic religion, health and utilization of maternal and child health services in Zimbabwe*. Harare: Collaborating Center for Operational Research and Evaluation and UNICEF. Retrieved from https://www.unicef.org/zimbabwe/ZIM_resources_apastolicreligion.pdf

Makumbe, J. (1996, March 21-25). Participatory development: The case of Zimbabwe. *Human Rights Bulletin*.

Mapuva, J. (2007). *An examination of the role played by selected civil society organisations in promoting democracy in Zimbabwe, 1980-2007*. Masters' thesis, University of the Western Cape, Cape Town.

Mandelbaum, A. G. (2011). *Strengthening parliamentary accountability, citizen engagement and access to information: A global survey of parliamentary monitoring organizations*. Washington, DC: National Democratic Institute (NDI) and World Bank Institute (WBI). Retrieved from https://www.ndi.org/sites/default/files/governance-parliamentary-monitoring-organizations-survey-september-2011.pdf

Mostert, B. J. (2004). *Parliamentary information sources, systems and services in South Africa and the role of parliamentary libraries in information provision*. PhD thesis, University of Zululand, KwaDlangezwa, South Africa.

National Research Council (NRC). (2014). Conducting research in developing countries. In *Culture matters: International research collaboration in a changing world (Summary of a workshop)*. Washington, DC: The National Acadamies Press.

Ngulube, P. (2010). Mapping mixed methods research in library and information science journals in Sub-Saharan Africa 2004–2008. *International Information & Library Review*, *42*(4), 252–261. https://doi.org/10.1080/10572317.2010.10762870

Peersman, G. (2014). *Overview: Data collection and analysis methods in impact evaluation.* Methodological Briefs: Impact Evaluation. UNICEF Office of Research. Retrieved from http://www.unicef-irc.org/KM/IE/

Republic of Zimbabwe. (2002a). Public Order and Security Act (POSA) (No. 1) of 2002.

Republic of Zimbabwe. (2002b). Access to Information and Protection of Privacy Act (AIPPA) (No. 5) of 2002.

Republic of Zimbabwe. (2013). Constitution of Zimbabwe Amendment Act (No. 20) of 2013.

Silverman, D. (2009). *Evaluating qualitative research* (3rd ed.). Thousand Oaks, CA: Sage.

UN Economic, Scientific and Cultural Organisation (UNESCO). (2009). *The 2009 UNESCO framework for cultural statistics*. Montreal: UNESCO Institute for Statistics.

Zimbabwe Electoral Commission (ZEC). (2008). *Report on the delimitation exercise for the 2008 harmonised elections*. Harare.

The Uncertain Path to Enterprise Architecture (EA) Maturity in the South African Financial Services Sector

Avsharn Bachoo
School of Economic and Business Sciences, University of the Witwatersrand (Wits), Johannesburg

Abstract
The research described in this article used the resource-based view (RBV) of the firm as an underlying theoretical framework to explore the relationship between enterprise architecture (EA) maturity and associated business value in the South African financial services environment. EA maturity was examined as an intangible resource and as a source of heterogeneity. The study identified the capabilities of business units at different levels of EA maturity, and found that EA is implemented at a coarse-grain level at lower organisational levels, and at finer-grain levels as one moves up the maturity curve. The study also found that EA is a source of both tangible and intangible forms of business value.

Keywords
resource-based view (RBV), enterprise architecture (EA), enterprise architecture (EA) maturity, financial services, business value, tangible business value, intangible business value, South Africa

DOI: https://doi.org/10.23962/10539/26110

Recommended citation
Bachoo, A. (2018). The uncertain path to enterprise architecture (EA) maturity in the South African financial services sector. *The African Journal of Information and Communication (AJIC), 21,* 97–119. https://doi.org/10.23962/10539/26110

This article is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence: http://creativecommons.org/licenses/by/4.0

1. Introduction

The business and information technology (IT) ecosystem is in a constant state of change (Santana et al., 2016). Organisations operate in a complex, highly dynamic environment, driven by technological advances, disruptive innovations, regulatory changes, and globalisation (Panetto et al., 2016). The available literature demonstrates rapid acceptance of enterprise architecture (EA) within the major sectors of the economy (Lapalme et al., 2016; Vallerand, Lapalme, & Moïse, 2017).

Research shows that EA is an instrument that can be used to reduce system complexity (Lankhorst, 2013; Lumor, Chew, & Gill, 2016); achieve business-IT alignment (Bricknall, Darrell, & Nilsson, 2006; Pereira & Sousa, 2005); improve system integration (Boh & Yellin, 2007; Venkatesh, Bala, Venkatraman, & Bates, 2007); enhance IT management and strategic competitiveness (Kappelman, 2010); and assist stakeholders to visualise design (Cardwell, 2008). These benefits illustrate the value and growing relevance of EA to organisations.

This article outlines the findings from a study of EA maturity and associated business value in the South African financial services sector. The sections that follow present the study's context and theoretical framing, the research purpose and methodology, the findings, and then a summary and conclusion.

2. Context and theoretical framing

How does EA maturity influence business value? This was the question that provided the focus for this study. Limited research has been conducted to explore the relationship between EA capabilities and organisational business value, and there is also minimal research which examines EA as an intangible resource and basis for business value (see Kaisler & Armour, 2017; Ross et al., 2006; Tamm, Reynolds, Seddon, Framption, & Shanks, 2015). Furthermore, available EA maturity studies (see Alwadain, Fielt, Korthaus, & Rosemann, 2014; Tamm et al., 2015; Vallerand et al., 2017) have not specifically focused on the way that EA affects business value outcomes at different maturity levels. These gaps are further compounded by inconsistencies in the definition (see Cronk & Fitzgerald, 1999) of the term "business value", as organisations use different definitions and have multiple interpretations of value (see Keyes-Pearce, 2005).

Investigating these matters is important in order for organisations to be able to understand the forms of business value that can be attained as they progress towards higher levels of EA maturity. Specifically, the aim of this research was to understand the connection between the EA practices of an organisation and the business value associated with those EA practices in the South African financial services environment.

The dynamic capabilities and resource-based view (RBV) frameworks were both considered for possible suitability to this study. Dynamic capabilities theory (Douma & Schreuder, 2013; Ludwig & Pemberton, 2011) takes an "outside in" (Teece, Pisano, & Shuen, 1997, p. 526) perspective, and focuses on an organisation's ability to "reconfigure resources" (Bowman & Ambrosini, 2010, p. 30) in order to address rapidly changing environments and industry forces (Teece et al., 1997). However, the dynamic capabilities framework has been criticised as not having a sufficiently clear, broadly accepted definition (Williamson, 2016); as lacking theoretical foundations; and as having poor empirical support (Easterby-Smith, Lyles, & Peteraf, 2009; Williamson, 2016)—as well as containing a complex and disconnected body of research (Barreto, 2009).

RBV (Barney, 1991; Rothaermel, 2015; Wernerfelt, 1984) takes an "inside out" perspective (Madhani, 2009, p. 4) and focuses on an organisation's creation, development, and choice of internal resources to create business value (Connor, 2002; Ludwig & Pemberton, 2011). This perspective seeks to give organisations the ability to innovate and envisage products that "customers need but have not yet even imagined" (Prahalad & Hamel, 1990, p. 6). RBV was selected as the underlying theoretical framework for this study because of its support of the research objectives, i.e., because RBV helps explain the ways in which EA capabilities can influence value for an organisation (Amit & Schoemaker, 1993; Seddon, 2014).

RBV states that organisations should look inside their environments for tangible and intangible sources of value (Barney, 1991; Rothaermel, 2015; Wernerfelt, 1984). Tangible resources are physical assets that are a source of short-term value and can be easily purchased in the open market (Barney, 1991; Schöenherr, 2009). Intangible resources have no physical presence, cannot be easily purchased, and are the primary source of long-term business value (Wade & Hulland, 2004). Heterogeneity assumes that intangible resources of organisations differ from each other and provide long-term business value (Barney, 1991; Patas, Bartenschlager, & Goeken, 2012). This study examined EA as an intangible resource (Ross et al., 2006; Tamm et al., 2015), and examined the maturity of EA as a source of heterogeneity (Anderson & Eshima, 2013; López, 2005). Understanding these elements is important because competitors cannot easily imitate intangible resources, due to their tendency towards heterogeneity (Barney, 1991; Rothaermel, 2015). It must be noted, however, that RBV has been criticised by some due to its arguably tautological definitions, and problems with its operationalisation (Priem & Butler, 2001; Williamson, 1999).

The quality management maturity grid (QMMG) (Crosby, 1979), stages of growth (Nolan, 1979), and capability maturity model integration (CMMI) (Paulk, Curtis, Chrissis, & Weber, 1993), were also assessed as possible suitable reference models for this study. CMMI is one of the most widely accepted and established models, in both academia and industry, for assessing the capability maturity of an

organisation (Fendt, 2013). Importantly, CMMI is used as a blueprint to derive other maturity models (Van Steenbergen, Schipper, Bos, & Brinkkemper, 2010), including the architecture capability maturity model (ACMM) (De Carvalho et al., 2016a, 2016b). ACMM was selected as the maturity model reference for this study, as it identifies levels of maturity and contains appropriate mechanisms—comprising processes, communication, business IT alignment, senior-management involvement, and finance—that were relevant to this study's aim to evaluate EA capabilities. Furthermore, the model describes five levels of maturity. During the first level of maturity, labelled *initial*, EA practices are ad hoc and inconsistent. During the second level of maturity, called *repeatable*, EA practices are simple. At the third level, called *defined*, EA is characterised by standard business practices. At the fourth level, labelled *managed*, EA practices are quantitatively managed with metrics. At the fifth level, called *optimised*, there are proactive EA practices (De Carvalho et al., 2016a; 2016b).

Examination of literature on the term "business value" revealed a wide range of views (see, for example, Chesbrough, 2012). Some contend that business value definitions are "unclear, frequently inadequate, often partisan and sometimes completely absent" (Bannister & Remenyi, 2000, p. 43). It has been argued that there is a "lack of construct validity, and definitional inconsistency" in the definitions of business value (Cronk and Fitzgerald, 1999, p. 406).

This study used the definition of business value provided by the RBV framework, whereby the term includes both tangible resources that are a source of short-term value and intangible resources that are a source of long-term value (Dyer, Singh, & Hesterly, 2018).

3. Research purpose and methodology

The research approached EA and EA maturity as phenomena having both tangible and intangible features (Ross et al., 2006; Tamm et al., 2015), and EA maturity as a source of value-creating heterogeneity (Anderson & Eshima, 2013; López, 2005), from an RBV perspective. The study sought to contribute to the RBV theory by examining EA maturity as a basis for the generation of both tangible and intangible business value (Ross et al., 2006; Tamm et al., 2015).

Furthermore, this research viewed EA in terms of granularities of refinement (Harrison, 2013). Coarse-grain refinement assesses EA from a conceptual perspective, in terms of business needs, objectives, goals, relationships and capabilities. The medium-grain refinement assesses EA from a logical perspective, in terms of how the conceptual view will be achieved. Finally, the fine-grain refinement assesses EA from a physical perspective, in terms of where the logical processes are implemented (Emery & Hilliard, 2009; Stuht & Speck, 2016).

The available literature (see Bui, 2012; Tamm et al., 2015; Vallerand et al., 2017; Wang & Zhao, 2009) does not show the granularities of EA refinement utilised at the different levels of maturity. Different EA granularities of refinement could influence business value differently at the various levels of EA maturity, and organisations can benefit from information on where to appropriately focus EA effort (Schekkerman, 2011).

The study used qualitative data-gathering methods, consisting of individual interviews and examination of document artefacts, all within a short timeframe. This provided the rich data necessary to deeply understand the constructs of EA maturity and business value within a time-bounded scope (Saint-Germain, 2016).

The South African financial services sector was selected as a setting for this study due to its strong regulatory, compliance, risk, and legal frameworks (Fosu, 2013; Luiz & Charalambous, 2009). The study collected data from business units in three South African banks: a total of nine business units of different sizes, complexities and maturity levels. Using a purposive sampling approach, a total of 28 individuals, all business and IT professionals, were interviewed across the nine units. Document artefacts were additionally analysed (Collis & Hussey, 2013), such as requirement documents (functionality specifications), architectural diagrams (software blueprints), design diagrams, and technical specifications.

Thematic analysis was used to analyse the data, search for patterns, and reveal themes (Braun & Clarke, 2006; Terry, Hayfield, Clarke, & Braun, 2017). Synchronic and inter-judge reliability criteria, as well as instrument, internal and construct validity criteria, were used (Miles, Huberman, & Saldana, 2014; Yin, 2013). Synchronic reliability—i.e., the consistency of outcomes observed from multiple sources within a similar period—was achieved for this study by using a standardised interview protocol and artefact form (Baskerville & Myers, 2015; Yin, 2013). These instruments were used for multiple participants and documents, after which similar patterns were investigated. Furthermore, I sought to achieve inter-judge reliability—i.e., identifying consistencies in observations by multiple observers—through the presentation of results, and discussions with participants, at conferences (DeVellis, 2003).

Triangulation of the interview data from different participants contributed to the internal validity of this research (Bisman, 2010; Denzin & Lincoln, 2011), and the document artefacts were collected to provide further insights into the responses from the interviews (Denzin & Lincoln, 2011). It must be noted that this study only focused on understanding and explaining a specific case-study environment (Dobson, Myles, & Jackson, 2007), as opposed to a focus on producing transferable and universally generalisable findings (Archer, Bhaskar, Lawson, & Norrie, 2013; Bhaskar, 2015).

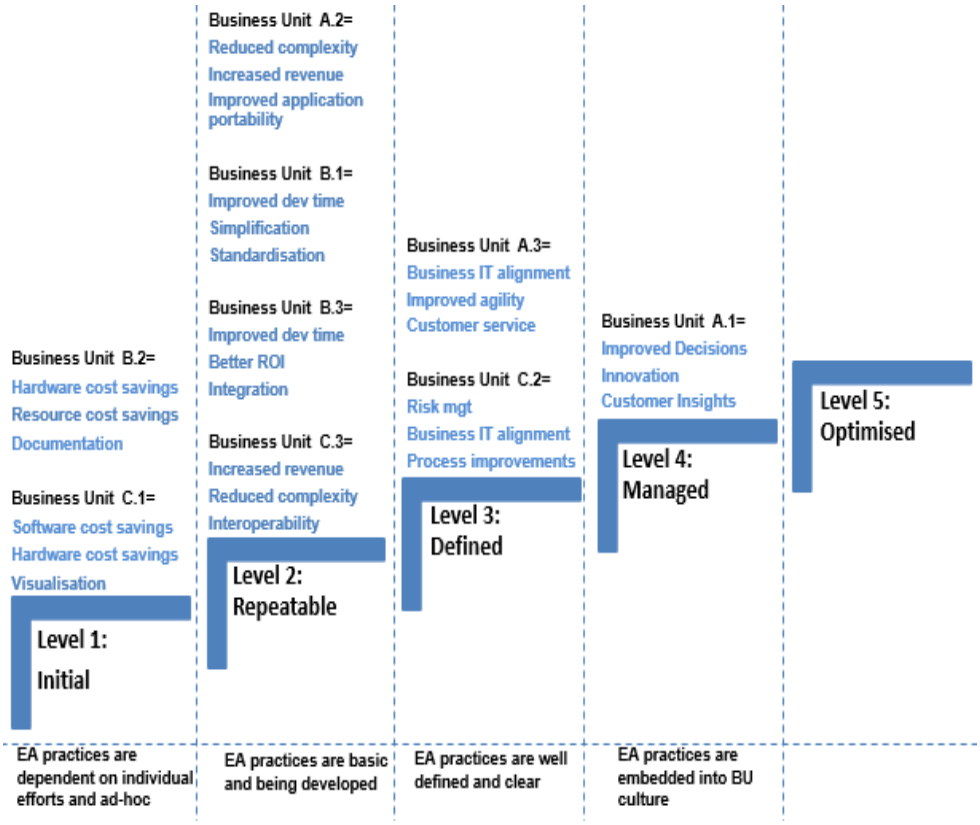
4. Findings on business units' EA maturity characteristics

This section consolidates and presents the findings from the nine business units assessed in this research. (The Appendix contains the interview questions used.) The thematic analysis findings on EA maturity characteristics are mapped in Figure 1, against four levels of EA maturity—with the names assigned to each level (*initial*, *repeatable*, *defined*, *managed*) taken from the ACMM framework outlined above:

- EA maturity level 1: initial
- EA maturity level 2: repeatable
- EA maturity level 3: defined
- EA maturity level 4: managed

None of the nine business units assessed was found to exhibit the characteristics of EA maturity level 5: optimised.

Figure 1: Business units' EA maturity characteristics



EA maturity level 1 characteristics

In Bank B, Business Unit 2 (B.2 in Figure 1), the thematic analysis identified the following theme: *informal EA capabilities and practices are new and still gaining momentum*. EA practices within this business unit were found to be inconsistent as they were dependent on specific staff members who advocated EA's value for particular projects. Furthermore, this business unit was characterised by an excessively high staff turnover rate, which resulted in only intermittent EA momentum. An inconsistent degree of management support, and internal conflict, featured within this business unit, with some managers advocating EA practices while others had no interest such activities.

This business unit defined its overall EA at a coarse granularity of refinement, as it focused on EA objectives and strategic goals without defining the ways in which these objectives and goals were to be executed. This business unit specified where its technology was physically deployed, and depicted the layers and environments developed with an open systems interconnection (OSI) reference model. Forms of value, such as improved documentation, were experienced. EA created a common platform and single view of initiatives for senior management. This helped manage stakeholder expectations and enabled consensus to be reached on matters of disagreement. Furthermore, EA influenced resource efficiencies which improved return on investment for the business unit. This led to hardware and software savings.

In Bank C, Business Unit 1 (C.1 in Figure 1), the following theme was identified: *EA practices dependent on individual person efforts*. The research found that this business unit had informal EA practices and capabilities that were dependent on specific staff. EA was implemented at a business unit level, as opposed to an organisational level, and was not linked to the bank's overall strategy. Basic EA practices evolved organically, with some management involvement. A committed budget for EA was available.

This business unit's environment was disorganised, with EA reliant on particular champions. However, these champions were often moved to projects that were in crisis, and EA expertise and knowledge left when these individuals were reassigned.

Similar to what was found at Bank B, Business Unit 2 (B.2), this business unit defined its overall EA at a coarse granularity of refinement without defining the ways in which EA objectives and goals were to be executed. This business unit specified the technology required to support its operations, which was comprised of a vendor-neutral architecture with a solution focus on simplicity that facilitated problem-solving. EA was found to be enabling rationalisation of applications, the reuse of technologies, and correct selection of technologies—resulting in software and hardware cost savings. Furthermore, EA blueprints enabled visualisation of systems by management.

EA maturity level 2 characteristics

In Bank A, Business Unit 2 (A.2 in Figure 1), the thematic analysis identified the following: *simple EA capabilities evident with basic EA practices being developed*. It was found that essential communication took place for all projects. There were formal design processes with, however, a few gaps prevalent. Furthermore, there was no future-state architecture in place. There was a shortage of skills, and a reliance on a few experts to execute initiatives. It was found that more management involvement was required to prevent project silos. Furthermore, this business unit was characterised by selective degrees of commitment from the senior managers.

This business unit defined its overall EA at a coarse granularity of refinement, as it focused on EA objectives and strategic goals without defining the ways in which these objectives and strategies were to be executed. Forms of value such as reduced complexity were experienced. EA enabled the business unit to generate a strategic view of its activities, characterised by a holistic view of its customer and a clearly structured approach to problem-solving. EA helped the unit convert complex technical details into simple business language that was easy for management to understand and agree on. Furthermore, EA enabled the business unit to visualise the impact of financial decisions, which helped the unit experience a quicker return on its investments and, in turn, increased revenue. Finally, the business unit experienced an improvement in the portability of its applications due to the influence of EA.

In Bank B, Business Unit 1 (B.1 in Figure 1), the thematic analysis identified: *EA in progress, with basic EA processes recently introduced and being formalised*. The use of EA was found to be resulting in simple business-IT alignment that was being experienced at a management level. However, more convincing was required on the use of EA to gain momentum, as it was not being fully leveraged by management. Senior management involvement with EA practices was erratic, with a mixed understanding of EA value. This business unit did have a few clear EA communication and governance standards that were documented within their repository. However, the communications occurred infrequently. Furthermore, there was only intermittent EA input into the finance strategy within this business unit.

This business unit had documentation available for its core and "as is" systems, but secondary and "to be" systems were still to be concluded. It was found that an EA repository has been developed, but navigation within this repository was difficult for staff. This business unit defined its overall EA at a coarse granularity of refinement, focused on EA objectives and strategic goals. Improved development time, simplification, and standardisation were identified as value experienced within the unit.

In Bank B, Business Unit 3 (B.3 in Figure 1), the theme determined was: *EA being established as well as EA processes being developed and communicated*. Basic EA

processes and up-to-date documentation were in place for critical core systems, and were stored within an EA repository. EA was found to be emerging as fundamental to business operations and useful for understanding regulations, with regular staff awareness activities taking place. Business-IT alignment was steadily progressing. Financial benefits such as risk reduction were experienced. There was gradually increasing involvement by senior managers in EA practices, but with varying degrees of commitment, with some managers advocating EA and other resisting or opposing any new practices. Additionally, there were staff problems in the unit with regard to focusing on EA, due to work overload. A dependency on specific individuals, as well as a skills gap, were problems.

EA was found to be enabling faster development time for building systems within the business unit. This business unit defined its overall EA at a coarse granularity of refinement, focused on EA objectives and strategic goals. The technology domain comprised a blueprint that depicted the configurations, servers, networks, vision, and strategy of the business unit. The EA repository facilitated reusability, resulting in faster system development and less integration complexity across systems in the bank. An improved return on investment had been achieved due to the faster deployment of systems.

In Bank C, Business Unit 3 (C.3 in Figure 1), the following theme was identified: *EA capabilities that are new and being set up with current-state-environment complete*. EA practices were being set up and the current-state-environment blueprints were complete. A technical reference model was being developed for EA. However, this model was not linked to the future target EA state. This business unit had built a shared folder to store its EA reference models, with EA communications taking place, but sporadically. A new management team, which supported EA, had recently been appointed, but there was some resistance, characterised by elements of internal politics.

Efficiency benefits, a small amount of business-IT alignment value, and financial benefits such as rationalisation and redundancy were being experienced. This business unit had a few EA finance standards were documented in the EA repository, but there was no formal finance strategy with regard to EA within the unit. The unit defined its overall EA at a coarse granularity of refinement, but had sought to specify some the ways in which the technology objectives were to be achieved by drawing up a collaborative framework that incorporated a strategic roadmap for interactions with business stakeholders. The roadmap further defined the locations of the deployment environments. Increased revenue, reduced complexity, and interoperability, were found to be as forms of value experienced because of EA.

EA maturity level 3 characteristics

In Bank A, Business Unit 3 (A.3 in Figure 1), the theme identified was: *formal EA capabilities as well as comprehensive EA processes supported by management, with current and future states integrated into the systems development life cycle (SDLC)*. There was found to be good management support for EA, coupled with strong business-IT alignment, allowed innovation and growth within this business unit. Senior management, including the CEO of the unit, actively supported and embraced EA practices. Furthermore, unit staff understood the benefit of EA and actively contributed to architectural initiatives. This unit had comprehensively documented governance processes of all its EA components.

This unit further included EA when making all financial decisions, and complied with EA standards when procuring any IT equipment, making use of a specialised EA tool. The unit defined its overall EA at a medium granularity of refinement, as it focused on the ways in which EA was executed by specifying its business, application, data, and technology domain processes from a logical perspective oriented towards how the conceptual view was to be achieved. Its technology domain artefact detailed a cloud technology stack incorporating software and infrastructure as a service model. The design included hardware, servers, and the network layout. Business-IT alignment was being experienced, as EA created a common platform for management to align strategies and to become more agile and responsive to change. Improved agility and improved customer were forms of value experienced by the unit.

In Bank C, Business Unit 2 (C.2 in Figure 1), the thematic finding was: *comprehensive EA capabilities and practices that are clear and regularly communicated to all staff*. This business unit had comprehensively documented its EA governance processes, future state architecture, EA standards, and reference models, and it had formed an EA architecture board. Furthermore, resource prioritisation was experienced, with strong business-IT alignment and a focus on business solutions. Senior management commitment to EA practices was experienced within the unit. Communication was prevalent, with the CIO providing frequent EA feedback to staff through emails. Furthermore, the unit's EA plans were linked to both the business unit and the bank's strategic and tactical plans. The document artefacts showed that this business unit had incorporated EA in its financial processes. The business unit had also procured an expert EA toolset.

This unit defined its overall EA at a medium granularity of refinement, as it focused on the ways in which EA was executed, specifying the domain processes. The technology comprised a model that depicted the current plumbing and served as a predictor to see the effects of changes, incorporating inputs, tools, and outputs. The business unit made use of reference models as a base, customisable for various segments. EA was found to be helping senior management mitigate risk by improving project selection, i.e., helping management make informed design choices

before systems were built. Efficiencies, such as improved processing times, were key forms of value being experienced through EA.

EA maturity level 4 characteristics

In Bank A, Business Unit 1 (A.1 in Figure 1), the theme established was: *entrenched, comprehensive and updated EA business practices that are well-established and part of the business unit culture*. This business unit distributed regular communications to its staff on the latest EA architecture developments and standards. Its EA practices were continuously advanced by management. The unit had built strong internal skills by sponsoring and encouraging EA training for staff. The unit recognised EA as a professional career with formal roles and responsibilities. The unit had further developed a defined formal path for architects to progress in their careers. A key differentiator at this level was that this business unit had specific metrics to evaluate its EA practices.

The business unit had predictive financial models that were available in the EA repository. Furthermore, senior management were proactively involved with the architecture board, and the unit's finance department reviewed EA before any major purchases. This unit defined its overall EA at a fine granularity of refinement, as it focused on where the physical implementation of EA was taking place. This business unit's technology domain artefacts described where the technology was physically deployed. The technology was designed as a hybrid, cloud-layered micro-services architecture that was stateless and resided in a container environment. Improved decision-making, innovation, and customer insights were forms of value being experienced as a result of EA.

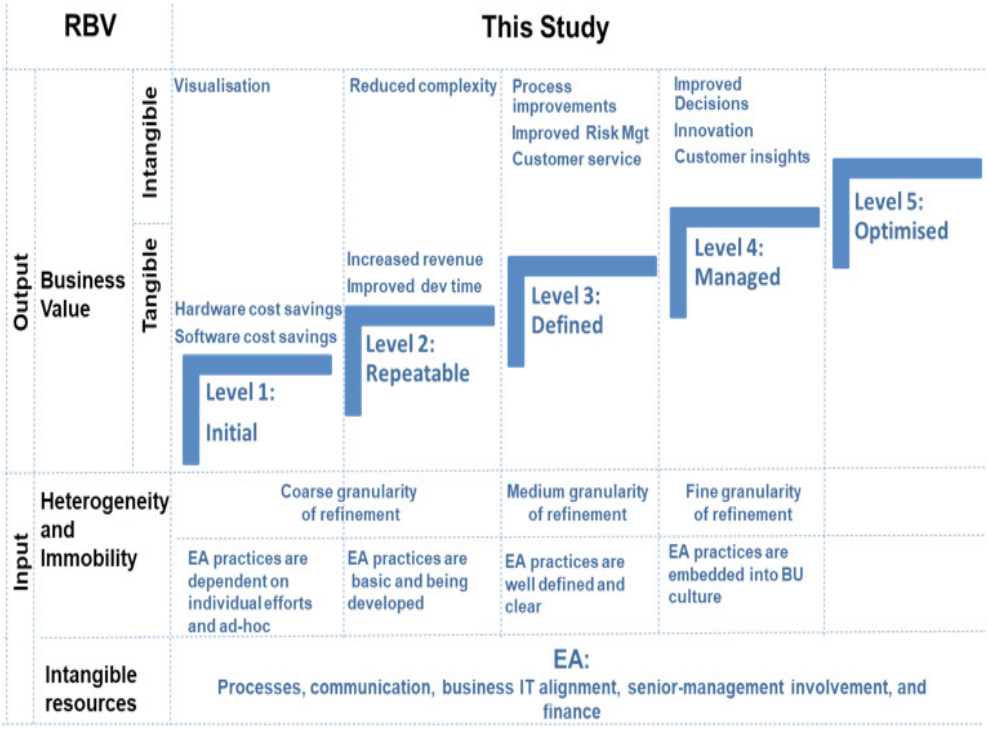
EA maturity level 5

The EA practices within ACMM at level 5 (optimised) are characterised in the literature as being predictive and in a state of continuous improvement (De Carvalho, Rocha, & de Vasconcelos, 2016; Paulk, Curtis, Chrissis, & Weber, 2001). None of the business units assessed in this study were found to feature elements of level 5 maturity.

5. Findings on business units' inputs and outputs at levels of EA maturity

As stated earlier, this study sought to examine EA as an intangible resource input (Boh & Yellin, 2007; Ross et al., 2006; Tamm et al., 2015) and maturity as a source of heterogeneity (Anderson & Eshima, 2013; López, 2005). The study further examined forms of business value as outputs. Figure 2 illustrates how the RBV framework helps reveal the ways in which organisations transform their inputs into outputs (Amit & Schoemaker, 1993; Dutta, Narasimhan, & Rajiv, 2005).

Figure 2: Business unit inputs and outputs at levels of EA maturity



Level 1 inputs and outputs

This research found that at level 1 maturity, EA practices were characterised as ad hoc, with no unified practices across the various EA domains, largely due to a dependency on specific individuals. EA documentation was a combination of high- and low-quality artefacts. The two business units at this level (B.2, C.1) perceived EA as a tool for the technology department to "draw diagrams" (B.2, interviewee 5) and document their systems. Moreover, there was minimal involvement of senior management with EA. To quote a research interviewee, "it's up to the architecture team to make a success of the situation" (C.1, interviewee 4).

However, it was found that even units taking advantage of EA on an ad hoc basis had the potential to experience immediate value. Tangible outcomes such as hardware and software cost savings are achieved through reuse of technologies, the correct selection of technologies, and improved documentation. Intangible outcomes, such as visualisation of systems, are attained through EA blueprints that help to horizontally view aspects of business and IT landscapes, and to improve procurement decisions by rationalisation of systems and licences.

A participant in one of the units at this EA maturity level stated that the unit reviewed its EA catalogue prior to large technology purchases. Previously, there had been three different reporting applications, two sales systems, and two bespoke customer relationship systems that performed similar functions within the bank. According to this participant, "we had a patchwork of independent systems […] architecture helped identify and eliminate these duplications […] this reduced IT spending across the group" (C.1, interviewee 4).

Level 2 inputs and outputs

The largest number of business units—four (A.2, B.1, B.3, C.3) out of the nine studied—fell within maturity level 2. Participant interviews a notably reduced dependency on specific individuals in comparison to level 1. These business units had simple blueprints as well as standards and principles for their current EA states. However, no evidence was found of future or target state architectures. It was found there was alignment between the business and technology departments at this level of maturity, as the technologies were mapped to the business objectives. According to one interviewee:

> [Our EA] is still fairly new, with a few holes missing, but still captures this department's structure in a formal design that supports our evolution and change […] it also ensures that our technical designs align to the bank's business strategic objectives. (A.2, interviewee 1)

However, business units at this level still perceived EA as a tool for the technology department, and EA still did not prominently feature within these business units' strategic agendas. There was found to be only selective involvement in EA by senior management, with varying degrees of commitment. According to one interviewee:

> The management team [has] agreed to get more involved with the architectural process […]. We will see how this evolves as it was only recently agreed and there is still internal squabbling amongst them. However, they all realise that architecture plays a key role in aligning our systems to meet customer needs. (A.2, interviewee 3).

Improved development time, a tangible outcome experienced by business units at this level, was found to be achieved via an EA repository of reusable components containing standard interfaces that reduced integration complexity. Intangible outcomes such as reduced complexity were also attained. According to one interviewee:

> Complexities began to emerge as the technologies began to overlap each other […]. We faced the problem of buying new technologies without decommissioning legacy systems […]. We eventually ended up with a tangle of overlapping new and old systems that no one really understands,

> and costs us money. Our architecture endeavours have played a role in reducing and managing the complexity chaos for us. (C.3, interviewee 3)

Level 3 inputs and outputs

The EA practices were found to be more structured within business units from level 3 onwards. The business units at this level (A3, C2) had simple EA practices in place that were well-accepted and communicated to the teams. They used EA processes to measure and share outcomes of projects with the staff. These outcomes were further used in post-implementation reviews and staff performance reviews. EA documentation at this level was comprehensive and, importantly, contained future target environments for the unit.

Business units at this level were found to be incorporating their EA practices into strategic planning, by creating a link between EA and key projects. According to one interviewee, "the architecture practices are entrenched into the project prioritisation forums, [and] can't be treated as a separate function" (C.2, interviewee 1). This linkage was found to be essentially forcing formal engagement between the unit's IT and business departments.

The C.2 business unit was found to be utilising financial metrics such as return on investment, net present value, and cost-benefit analysis; customer metrics such as customer satisfaction surveys, call-centre-holding time, and problem-resolution time; process metrics such as measuring task times; and compliance metrics such as compliance frameworks. A C.2 interviewee stated: "I see our architecture as the plumbing of the business […]. It details the inputs, tools, and outputs" (C.2, interviewee 1). It was found at this level that EA aided business units with process improvements by helping them to visualise and understand complex interconnections between processes that were confusing or conflicting.

Another intangible form of value found at this level was improved risk management. The business units at this level cited the stringent legislative regulations within the sector, as well as frequent amendments to these regulations, and said that EA was found to create value by addressing various risk regulations in a holistic manner across departments in a unit. Improved customer service was another intangible outcome that started to become prominent at this level. The units studied at this level found EA beneficial in mapping their customers' journey across individual departments, with EA helping to facilitate collaboration via sharing customer experiences and identifying service problems that emerged at the handoff points between the departmental silos.

Level 4 inputs and outputs

The one business unit (A.1) at maturity level 4 viewed EA as a practice that involved applying a set of tools and techniques to solve business problems. EA was entrenched

into the business decision-making process. To quote one interviewee, "EA [is] integrated into our strategy and core business activities" (A.1, interviewee 4).

This business unit was using metrics such as Delphi techniques, frequency analysis, and percentages of reuse of common designs, which specifically measured aspects of EA. (However, one of the unit's challenges was the inconsistent use of these measures.)

This unit kept its EA documentation updated by reflecting the latest architectures in their production environments. Senior management was actively involved with EA reviews and enhancements. To quote another interviewee, "Manco [the management committee] are part of the architecture review board" (A.1, interviewee 1).

Blueprints and diagrams generated from EA assisted the business unit to visualise and identify patterns in data that subsequently helped it make better decisions. EA enabled innovation by assisting with the rapid implementation of new ideas, and it assisted the unit to understand the potential impact of changes brought about by innovations. A key intangible outcome was found to be enhanced customer insights. According to one interviewee:

> a few years ago, a customer walked into a branch and took out a personal loan [and] we did a credit check, and the transaction was simply processed […]. These days, it goes beyond that transaction [...]. We look at things such as Tweets and Facebook comments to check for any cross-sale opportunities […]. The key is offering the right product at the right place and at the right time, tailored for that specific customer (A.1, interviewee 3).

EA was enabling the business unit to create tailored offerings of products that directly targeted customer-specific needs. EA structures were further helping the unit to gain insights by connecting disparate data silos to create a single, integrated view of a customer.

6. Summary and conclusion

The literature survey for this study established that business value in the form of *reduced system complexity* is attainable from EA (Lapalme et al., 2016; Rouhani, Mahrin, Nikpay, & Nikfard, 2013). This study found that reduced system complexity was only achievable for organisations operating from EA maturity level 2 onwards.

The literature review also established that business value in the form of *improved system integration and standardisation* is attainable from EA (Boh & Yellin, 2007; Venkatesh et al., 2007). The findings of this study concur with the literature, establishing that this form of value was attainable for the business units from level 2 maturities onwards.

It was also established via the literature review that *efficient IT management,* leading to reduced solution delivery time and development costs, is a form of value generated by EA (Bernard, 2012; Kappelman, McLean, Johnson, & Torres, 2016). The findings of this study concur with the literature, finding that this forms of value was attainable across the units, even at level 1 maturity.

The literature review also established that some works position *business-IT alignment* as achievable from EA (Bricknall et al., 2006; Pereira & Sousa, 2005). This study findings of this study place more emphasis on business-IT alignment as a source of value, rather than as an outcome, through connecting business and technology components through common threads (see Harrison, 2013; Kurniawan & Suhardi, 2013).

We also saw that it is argued in some of the literature that EA creates *long-term value but minimal short-term value* (Bricknall et al., 2006; Van Der Raadt & Van Vliet, 2009). And the RBV theoretical framework used for this study argues that tangible resources are a source of short-term value, and intangible resources are a source of a long-term value (Barney, 1991). This study identified both tangible and intangible forms of value obtainable from EA, implying that EA is a source of both short-term and long term-value.

Key specific findings were as follows:

Champions: EA champions were found to be influential in helping business units move up the maturity curve. These champions were found to be collaborating with business stakeholders and positioning EA as a joint business-IT venture.

Standardised technologies: Business units across level 1 and 2 maturities had large, diversified portfolios of programming languages, technology infrastructure, and toolsets. This was in contrast to business units at levels 3 and 4, which had implemented standard programming languages and consistent technology infrastructure stacks across a variety of applications. They were using standardised, off-the-shelf packaged technologies within minimal or no customisation. This use of standardised technologies prevented future interface complexity.

Skills: The availability of skilled resources was found to be a major challenge to EA success. Furthermore, business units at lower levels of maturity did not recognise and fully acknowledge EA as a formal career. Conversely, business units at levels 3 and 4 had acknowledged this career path, and had built strong internal skills by sponsoring and encouraging EA training, had recognised EA as a professional career path with formal roles and responsibilities, and had positioned architects at high levels of seniority with substantial decision-making power.

EA as a practice: The business units at lower maturity levels perceived EA as a blueprint, and as primarily a set of technology decisions. In contrast, the business unit at level 4 maturity viewed EA as a practice, involving application of a set of tools and techniques to solve business problems. Furthermore, this business unit at level 4 had structured EA to target critical business projects, ensuring that EA remained visible and relevant to the business unit through its association with the benefits created by the critical projects. This is a lesson for lower-maturity-level business units wanting to gain momentum in their EA efforts.

Metrics: The study found that business units from maturity levels 1 to 3 utilised financial metrics, customer metrics, process metrics, and compliance metrics. The differentiator at level 4 was the use of statistical metrics specifically designed to measure EA. The level 4 business unit used Delphi techniques to enhance EA decision-making, and frequency analysis to determine patterns for EA improvement.

Customer insights: Customer insights were found to be a sought-after type of value identified by the business units studied. All the business units aspired to achieve this form of value, as it would allow them to understand customer behaviour and subsequently create personalised sales and service offerings. However, it was found that only the unit at level 4 maturity had consolidated its individual databases from the various systems into a single integrated data warehouse providing the ability to search for patterns and proactively present offers to customers based on their behaviours. This architecture contrasted with business units at lower levels of maturity that had different databases for each function. Business units at lower EA maturity levels were experiencing many missed opportunities due to not having a single consolidated view of customer behaviour.

Refinement of EA granularity: This study found a refinement in the granularity of EA as business units moved up the maturity curve. Business units across levels 1 and 2 maturities applied EA at a coarse granularity of refinement, with a focus on defining EA domain objectives and goals. At level 3 maturity, a medium granularity of refinement emerged. At this level, in addition to defining the domain objectives and goals, the units defined the ways in which the objectives were achieved, and specified the application software, particular technologies, and data types and views. The business unit with level 4 maturity defined EA at an even finer granularity of refinement, containing details such as where the physical implementation was taking place and the roles of stakeholders performing the tasks.

In conclusion, this study's findings concur with the argument made 15 years ago by Carr (2003) in the controversial, but still relevant, article entitled "IT Doesn't Matter", which suggested that the only way to get value from IT is to build it into the business. Although EA is not the panacea or "silver bullet" (Brooks, 1987, p. 10) to all issues associated with achieving value, it is definitely a vital piece to the

puzzle. A core finding presented in existing literature is that organisations that adopt EA obtain value, even on an ad hoc basis (Ross et al., 2006; Tamm et al., 2015). This study has sought to add nuance to that finding, by looking at how EA capabilities evolve at different levels of maturity, and at the types of short-term and long-term value attainable.

References

Alwadain, A., Fielt, E. B., Korthaus, A. C., & Rosemann, M. (2014). A critical realist perspective of enterprise architecture evolution: Conditioning and outcomes. *Australasian Journal of Information Systems*, *18*(3), 213–226. https://doi.org/10.3127/ajis.v18i3.1102

Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, *14*(1), 33–46. https://doi.org/10.1002/smj.4250140105

Anderson, B. S., & Eshima, Y. (2013). The influence of firm age and intangible resources on the relationship between entrepreneurial orientation and firm growth among Japanese SMEs. *Journal of Business Venturing*, *28*(3), 413–429. https://doi.org/10.1016/j.jbusvent.2011.10.001

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Barreto, I. (2009). Dynamic capabilities: A review of past research and an agenda for the future. *Journal of Management*, *36*(1), 256–280. https://doi.org/10.1177/0149206309350776

Baskerville, R. L., & Myers, M. D. (2015). Design ethnography in information systems. *Information Systems Journal*, *25*(1), 23–46. https://doi.org/10.1111/isj.12055

Bernard, S. (2012). *An introduction to enterprise architecture*, 3rd ed. Bloomington, IN: AuthorHouse.

Bhaskar, R. (2015). *A realist theory of science*. London: Routledge. https://doi.org/10.4324/9780203090732

Bisman, J. (2010). Postpositivism and accounting research: A (personal) primer on critical realism. *Australasian Accounting Business & Finance Journal*, *4*(4), 3–25.

Boh, W. F., & Yellin, D. (2007). Using enterprise architecture standards in managing information technology. *Journal of Management Information Systems*, *23*(3), 163–207. https://doi.org/10.2753/mis0742-1222230307

Bowman, C., & Ambrosini, V. (2010). How value is created, captured and destroyed. *European Business Review*, *22*(5), 479–495. https://doi.org/10.1108/09555341011068903

Bradley, R. V., Pratt, R. M. E., Byrd, T. A., Outlay, C. N., & Wynn, D. E. (2012). Enterprise architecture, IT effectiveness and the mediating role of IT alignment in US hospitals. *Information Systems Journal*, *22*(2), 97–127. https://doi.org/10.1111/j.1365-2575.2011.00379.x

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bricknall, R., Darrell, G., & Nilsson, H. (2006). Enterprise architecture: Critical factors affecting modelling and management. In ECIS (Ed.), *14th European Conference of Information Systems (ECIS 2006)* (pp. 1–13).

Brooks, F. (1987). No silver bullet: Essence and accidents of software engineering. *Computer*, *20*(4), 10–19. https://doi.org/10.1109/mc.1987.1663532

Bui, Q. N. (2012). Making connections: A typological theory on enterprise architecture features and organizational outcomes. In AMCIS (Ed.), *Eighteenth Americas Conference on Information Systems* (pp. 1–9).

Cardwell, G. (2008). The influence of enterprise architecture and process hierarchies on company success. *Total Quality Management & Business Excellence*, *19*(1–2), 47–55. https://doi.org/10.1080/14783360701601959

Chesbrough, H. W. (2012). Open innovation: Where we've been and where we're going. *Research-Technology Management*, *55*(August), 20–27. https://doi.org/10.5437/08956308x5504085

Collis, J., & Hussey, R. (2013). Business Research. *Nature*, *142*, 410–411. https://doi.org/10.1038/142410a0

Connor, T. (2002). The resource-based view of strategy and its value to practising managers. *Strategic Change: Briefings in Entrepreneurial Finance*, *11*(6), 307–316. https://doi.org/10.1002/jsc.593

Cronk, M. C., & Fitzgerald, E. P. (1999). Understanding "IS business value": Derivation of dimensions. *Logistics Information Management*, *12*(1/2), 40–49. https://doi.org/10.1108/09576059910256240

Crosby, P. B. (1979). *Quality is free: The art of making quality certain*. New York: New American Library.

De Carvalho, J. V., Rocha, Á., & Abreu, A. (2016). Maturity models of healthcare information systems and technologies: A literature review. *Journal of Medical Systems*, *40*(6), 1–10. https://doi.org/10.1007/s10916-016-0486-5

De Carvalho, J. V., Rocha, Á., & De Vasconcelos, J. B. (2016). Maturity models for hospital information systems management: Are they mature? *Innovation in Medicine and Healthcare, 2015*, 541–552. https://doi.org/10.1007/978-3-319-23024-5_49

Denzin, N. K., & Lincoln, Y. S. (Eds.). (2011). *The SAGE handbook of qualitative research*. Thousand Oaks, CA: Sage. https://doi.org/10.1108/13522750910948815

DeVellis, R. F. (2003). *Scale development: Theory and applications.* 2nd ed. Thousand Oaks, CA: Sage.

Douma, S. W., & Schreuder, H. (2013). *Economic approaches to organizations*. New York: Prentice Hall.

Dutta, S., Narasimhan, O. M., & Rajiv, S. (2005). Conceptualizing and measuring capabilities: Methodology and empirical application. *Strategic Management Journal*, *26*(3), 277–285. https://doi.org/10.1002/smj.442

Dyer, J. H., Singh, H., & Hesterly, W. S. (2018). The relational view revisited: A dynamic perspective on value creation and value capture. *Strategic Management Journal, 39*(12), 3140-3162. https://doi.org/10.1002/smj.2785

Easterby-Smith, M., Lyles, M. A., & Peteraf, M. A. (2009). Dynamic capabilities: Current debates and future directions. *British Journal of Management*, *20*(SUPP. 1), S1–S8. https://doi.org/10.1111/j.1467-8551.2008.00609.x

Emery, D., & Hilliard, R. (2009). Every architecture description needs a framework: Expressing architecture frameworks using ISO/IEC 42010. In WICSA/ECSA (Ed.), *2009 Joint Working IEEE/IFIP Conference on Software Architecture and European Conference on Software Architecture* (pp. 31–40). https://doi.org/10.1109/wicsa.2009.5290789

Fendt, J. (2013). CEOs and popular management concepts: Innovation heuristics, boundary capability and effectuation. *Academy of Management Proceedings*, *2013*(1). https://doi.org/10.5465/ambpp.2013.260

Fosu, S. (2013). Banking competition in Africa: Subregional comparative studies. *Emerging Markets Review*, *15*, 233–254. https://doi.org/10.1016/j.ememar.2013.02.001

Harrison, R. (2013). *TOGAF 9 foundation study guide*. Berkshire, UK: The Open Group.

Kaisler, S. H., & Armour, F. (2017). 15 years of enterprise architecting at HICSS: Revisiting the critical problems. In HICSS (Ed.), *Proceedings of the 50th Hawaii International Conference on System Sciences* (pp. 4807–4816). https://doi.org/10.24251/hicss.2017.585

Kappelman, L. A. (2010). *The SIM guide to enterprise architecture*. Boca Raton, FL: CRC Press. https://doi.org/10.1201/9781439811146

Kappelman, L. A., McLean, E., Johnson, V., & Torres, R. (2016). The 2015 SIM IT issues and trends study. *MIS Quarterly Executive*, *15*(1), 55–83.

Keyes-Pearce, S. V. (2005). *IT value management in leading firms: The fit between theory and practice*. Doctoral dissertation, University of Sydney.

Khaiata, M., & Zualkernan, I. A. (2009). A simple instrument to measure IT-business alignment maturity. *Information Systems Management*, *26*(2), 138–152. https://doi.org/10.1080/10580530902797524

Kurniawan, N. B., & Suhardi. (2013). Enterprise architecture design for ensuring strategic business IT alignment (integrating SAMM with TOGAF 9.1). In IEEE (Ed.), *Proceedings of the 2013 Joint International Conference on Rural Information and Communication Technology and Electric-Vehicle Technology, rICT and ICeV-T*. https://doi.org/10.1109/rict-icevt.2013.6741505

Lankhorst, M. (2013). Enterprise architecture at work: Modelling, communication and analysis. In J. L. G. Dietz, E. Proper, & J. Tribolet (Eds.), *The enterprise engineering series, Vol. 27*. Berlin: Springer. https://doi.org/10.1007/978-3-642-29651-2

Lapalme, J., Gerber, A., Van Der Merwe, A., Zachman, J., Vries, M. De, & Hinkelmann, K. (2016). Exploring the future of enterprise architecture: A Zachman perspective. *Computers in Industry*, *79*, 103–113. https://doi.org/10.1016/j.compind.2015.06.010

López, S. V. (2005). Competitive advantage and strategy formulation: The key role of dynamic capabilities. *Management Decision*, *43*, 661–669. https://doi.org/10.1108/00251740510597699

Ludwig, G., & Pemberton, J. (2011). A managerial perspective of dynamic capabilities in emerging markets: The case of the Russian steel industry. *Journal for East European Management Studies*, *16*(3), 215–236. https://doi.org/10.5771/0949-6181-2011-3-215

Luiz, J. M., & Charalambous, H. (2009). Factors influencing foreign direct investment of South African financial services firms in Sub-Saharan Africa. *International Business Review*, *18*(3), 305–317. https://doi.org/10.1016/j.ibusrev.2009.02.008

Lumor, T., Chew, E., & Gill, A. Q. (2016). Exploring the role of enterprise architecture in IS-enabled Ot: An EA principles perspective. In IEEE (Ed.), *Enterprise Distributed Object Computing Workshop (EDOCW)* (pp. 1 –6). https://doi.org/10.1109/edocw.2016.7584360

Madhani, P. M. (2009). Resource based view (RBV) of competitive advantages: Importance, issues and implications. *Indian Management Research Journal*, *1*(2), 1-15.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook*. Thousand Oaks, CA: Sage. https://doi.org/10.2307/1163741

Nolan, R. L. (1979). Managing the crises in data processing. *Harvard Business Review*, *57*(March), 115–127.

Panetto, H., Zdravkovic, M., Jardim-Goncalves, R., Romero, D., Cecil, J., & Mezgár, I. (2016). New perspectives for the future interoperable enterprise systems. *Computers in Industry*, *79*(C), 47–63. https://doi.org/10.1016/j.compind.2015.08.001

Patas, J., Bartenschlager, J., & Goeken, M. (2012). Resource-based view in empirical it business value research--an evidence-based literature review. *2012 45th Hawaii International Conference on System Sciences*, 5062–5071. https://doi.org/10.1109/hicss.2012.503

Paulk, M. C., Curtis, B., Chrissis, M. B., & Weber, C. V. (1993). Capability maturity model, version 1.1. *IEEE Software*, *10*(4), 18–27. https://doi.org/10.1109/52.219617

Paulk, M. C., Curtis, B., Chrissis, M. B., & Weber, C. V. (2001). Capability maturity model for software. In R. H. Thayer (Ed.), *Software engineering project management* (2nd ed.) (pp. 48-59). Los Alamitos, CA: IEEE Computer Society Press.

Pereira, C. M., & Sousa, P. (2005, March). Enterprise architecture: Business and IT alignment. In *Proceedings of the 2005 ACM Symposium on Applied Computing* (pp. 1344-1345). https://doi.org/10.1145/1066677.1066980

Prahalad, C. K., & Hamel, G. (1990). Strategic intent. *Harvard Business Review*, *67*(3), 63-76.

Priem, R. L., & Butler, J. E. (2001). Tautology in the resource-based view and the implications of externally determined resource value: Further comments. *Academy of Management Review, 26*(1), 57-66. https://doi.org/10.5465/amr.2001.4011946

Ross, J. W., Weill, P., & Robertson, D. (2006). *Enterprise architecture as strategy: Creating a foundation for business execution*. Cambridge, MA: Harvard Business Press.

Rothaermel, F. T. (2015). *Strategic management: Concepts and cases*. New York: McGraw-Hill Irwin.

Rouhani, B. D., Mahrin, M. N., Nikpay, F., Ahmad, R. B., & Nikfard, P. (2015). A systematic literature review on enterprise architecture implementation methodologies. *Information and Software Technology*, *62*, 1–20. https://doi.org/10.1016/j.infsof.2015.01.012

Rouhani, B. D., Mahrin, M. N., Nikpay, F., & Nikfard, P. (2013). A comparison enterprise architecture implementation methodologies. In IEEE (Ed.), *Proceedings - 2013 International Conference on Informatics and Creative Multimedia* (pp. 1–6). https://doi.org/10.1109/icicm.2013.9

Saint-Germain, M. A. (2016). Pre-experimental designs for research. Retrieved from http://web.csulb.edu/~msaintg/ppa696/696preex.htm#Cross-Sectional Design

Santana, A., Fischbach, K., & Moura, H. (2016, January). Enterprise architecture analysis and network thinking: A literature review. In Hawaii International Conference on System Sciences (HICSS) (Ed.), *2016 49th Hawaii International Conference on System Sciences* (pp. 4566-4575). https://doi.org/10.1109/hicss.2016.567

Saunders, M. L., Lewis, P., & Thornhill, A. (2016). *Research methods for business students*. London: Financial Times.

Schekkerman, J. (2011). Enterprise Architecture Tool Selection Guide. *Institute for Enterprise Architecture Developments*. Trafford.

Schöenherr M. (2009) Towards a common terminology in the discipline of enterprise architecture. In G. Feuerlicht, & W. Lamersdorf (Eds.), Service-oriented computing – ICSOC 2008 Workshops. ICSOC 2008. Lecture Notes in Computer Science, Vol. 5472. Berlin: Springer. https://doi.org/10.1007/978-3-642-01247-1_40

Seddon, P. B. (2014). Implications for strategic IS research of the resource-based theory of the firm: A reflection. *The Journal of Strategic Information Systems*, *23*(4), 257–269. https://doi.org/10.1016/j.jsis.2014.11.001

Silverman, D. (2013). *Doing qualitative research: A practical handbook*. London: Sage.

Stuht, T., & Speck, A. (2016). Bridging the gap between independent enterprise architecture domain models. In W. Abramowicz, R. Alt, & B. Franczyk (Eds.), *Business Information Systems (BIS 2016): Lecture Notes in Business Information Processing, Vol. 255* (pp. 277–288). Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-319-39426-8_22

Tamm, T., Reynolds, P., Seddon, P. B., Framption, K. M., & Shanks, G. (2015). How an Australian retailer enabled business transformation through enterprise architecture. *MIS Quarterly Executive*, *14*(4), 181–193.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(3), 509–533. https://doi.org/10.1002/(sici)1097-0266(199708)18:7<509::aid-smj882>3.0.co;2-z

Terry, G., Hayfield, N., Clarke, V., & Braun, V. (2017). Thematic analysis. In C. Willig, & W. Stainton Rogers (Eds.), *The SAGE Handbook of Qualitative Research in Psychology*, 17–35. http://dx.doi.org/10.4135/9781526405555.n2

Vallerand, J., Lapalme, J., & Moïse, A. (2017). Analysing enterprise architecture maturity models: A learning perspective. *Enterprise Information Systems*, *11*(6), 859–883. https://doi.org/10.1080/17517575.2015.1091951

Van der Raadt, B., & Van Vliet, H. (2009). Assessing the efficiency of the enterprise architecture function. In *Working Conference on Practice-Driven Research on Enterprise Transformation* (pp. 63-83). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-01859-6_5

Van Steenbergen M., Schipper, J., Bos, R., & Brinkkemper, S. (2010). The dynamic architecture maturity matrix: Instrument analysis and refinement. In A. Dan, F. Gittler, & Toumani F. (Eds.), *ICSOC/ServiceWave 2009, Lecture Notes in Computer Science (LNCS)*, Volume 6275 (pp. 48–61). https://doi.org/10.1007/978-3-642-16132-2_5

Venkatesh, V., Bala, H., Venkatraman, S., & Bates, J. (2007). Enterprise architecture maturity: The story of the Veterans Health Administration. *MIS Quarterly Executive*, *6*(2), 79–90.

Wade, M., & Hulland, J. (2004). The resource-based view and information systems research: Review, extension, and suggestions for future research. *MIS Quarterly*, *28*(1), 107–142. https://doi.org/10.2307/25148626

Wang, X., & Zhao, Y. (2009, August). An enterprise architecture development method in Chinese manufacturing industry. In IEEE (Ed.), *2009 Ninth International Conference on Hybrid Intelligent Systems* (pp. 226-230), 12-14 August, Shenyang, China. https://doi.org/10.1109/his.2009.260

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*, 171–180. https://doi.org/10.1002/smj.4250050207

Williamson, O. E. (1999). Strategy research: Governance and competence perspectives. *Strategic Management Journal*, *20*(12), 1087–1108. https://doi.org/10.1002/(sici)1097-0266(199912)20:12<1087::aid-smj71>3.3.co;2-q

Williamson, P. (2016). Building and leveraging dynamic capabilities: Insights from accelerated innovation in China. *Global Strategy Journal*, *6*(3), 197–210. https://doi.org/10.1002/gsj.1124

Yin, R. K. (2013). *Case study research: Design and methods*. Thousand Oaks, CA: Sage.

Appendix: Interview questions

1. In what way have your business unit's EA processes been established?
2. In what way do these EA processes bring value to your department?
3. In what way has the progression of your business unit's EA been communicated?
4. In what way does EA communication help you to bring value to your department?
5. In what way has introducing EA influenced business-IT alignment in your business unit?
6. In what way does EA bring value in terms of achieving business and IT alignment?
7. In what way are the senior managers of your business unit involved in the establishment and ongoing development of EA?
8. In what way does EA bring value to senior managers in your business unit?
9. In what way has introducing EA influenced your finance strategy?
10. In what way does EA bring value to finance in your department?

THE AFRICAN JOURNAL OF INFORMATION AND COMMUNICATION (AJIC)

Published by the LINK Centre
University of the Witwatersrand (Wits)
Johannesburg, South Africa
www.wits.ac.za/linkcentre

ISSN 2077-7213 (online version)
ISSN 2077-7205 (print version)