ICT regulation for fostering the digital complexity economy

in the SADC region 2016 – 2030

ACER Conference, Livingstone, Zambia, 10 – 11 March 2016

Lucienne Abrahams, LINK Centre, University of the Witwatersrand, Johannesburg, South Africa

Abstract— This paper discusses key issues in regulation for the next decade of digital economy evolution in the SADC region, including regulation for the advancement of e-services, such as mobile money, mobile payments, Internet of Things, e-education, e-health, thereby promoting the expansion and evolution of cyberspace and the universality of participation in cyberspace. It considers these issues in regulation within the framework of a "digital complexity economy", meaning that developing country economies encounter uncertainties and unpredictability as they transition into digitally oriented economies. Key issues for consideration are regional regulatory agendas, model laws and codes, and concurrent jurisdiction amongst multiple regulators.

Keywords—digital complexity economy, SADC region, ICT regulation, mobile money regulation, IoT and IoP regulation, concurrent jurisdiction of multiple regulators

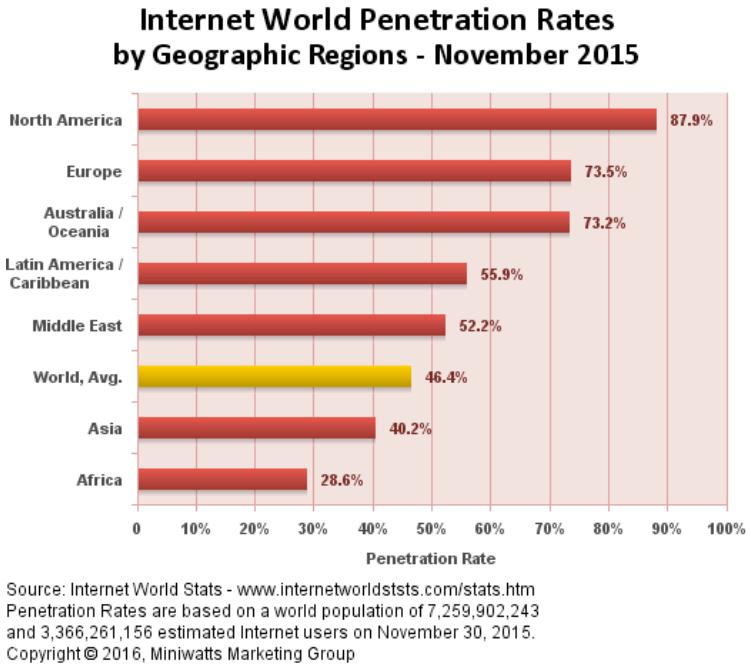
I. INTRODUCTION: CONTEMPLATING THE DIGITAL COMPLEXITY ECONOMY

The 21st century era of Internet-based life introduces very high levels of complexity, such that regulation in this era may be referred to as regulation for a "digital complexity economy". Digital complexity involves "the interconnected facets of globalization; knowledge, innovation and learning; mobile, wireless and broadband communications; and the shift from relatively simple and basic forms of e-commerce and e-government to the complex e-transformation of all sectors of the economy, from agriculture to manufacturing and knowledge services" (Abrahams, 2015). Regulation of electronic communications markets and Internet-based services markets (not the Internet itself) requires advances in the institutional environment towards extensive and intensive knowledge formation, in order for regulatory bodies to remain relevant. Failure to command such knowledge will make regulatory institutions all but irrelevant to the future digital economy in the next ten years, because the pace of change towards digital economies far exceeds the pace of expansion of knowledge amongst regulators in the SADC region.

Starting approximately two decades ago, researchers studied the social and economic regulation of telecoms infrastructures and services, in particular regulatory approaches to creating market structures and the transition from monopoly to competition (Boylaud & Nicoletti, 2001; Buigues, 2006; Bourreau & Dogan, 2004; Fredebeul-Krein & Freytag, 1999; Gillwald, 2005; Noll, 1999); they studied regulation for the mobile communications economy (Gebreab, 2002; Haucap, 2003; Nanevie, 2012); then they studied the broadband Internet economy and its development (Fransman, 2007; Kelly, Mulas, Raja, Qiang, & Williams, 2009; Czernich, Falck, Kretschmer, & Woessman, 2011). In 2016, scholars study regulation in the cyber economy, including with respect to the Internet of Things (Brown, 2015), cloud computing (Etro, 2011) and the associated risks, including security, privacy and legal contract issues (Hinde & van Belle, 2012; Maaref, 2012; Hutchings, Smith & James, 2013; Millard, 2013). Hernandez Leza and Ballot-Lena (2010) and Hanna (2015) make a particular effort to discuss "ICT regulation in the digital economy" and policy for

"transforming to a networked society". All these and other works point to a relatively high degree of complexity in law making, in rule making, in the compliance with law and regulation, and in the transitions from one historical period of regulation to the next.

The digital information economy of apps, OTT services, mobile money and online education, online entertainment, e-health, Netflix, is shifting the African economy to an Internet-based economy. But where and how does ICT sector and related regulation need to change in the next five to ten years for African economies to transition more capably? What does universal access and service mean with respect to the proportion of economic and social actors on the continent that have access the information economy, and with respect to universality of online e-services and m-services for education, health, banking and finance? While mobile access has increased significantly, (i) to 386 million unique subscribers or a 41 percent penetration rate (2015); (ii) to mobile Internet subscriber penetration estimated of around 20 percent and total Internet penetration estimated between 17 percent and 28.6 percent (GSMA, 2015; Internet Society, 2015; Internet World Stats, 2015; ITU, 2014; ITU, 2015); and (iii) there is an apparent trend towards mobile broadband substitution in the next five years, it is envisaged that less than 50 percent of the projected billion-plus population of Africa will have mobile broadband Internet access (in other words usable Internet) by 2020 (GSMA, 2015).



The growth in smartphone devices will certainly push forward the quality of the Internet user experience, however, the industry association data and projections suggest that there will be only 525 million smartphones by 2020, continuing the classic digital divide (GSMA, 2015). It is not known how many of these will be second-hand smartphones, but it is reasonable to suggest that (a) this would be a significant proportion and (b) smartphones will be very much an urban phenomenon. With reference to this short overview, key issues in regulation discussed in this paper therefore include mobile money regulation, regulation with respect to cloud computing, Internet of Things regulation, e-education regulation, e-health regulation and universality.

Furthermore, it is not possible, in this paper, to present an overview of the current state of ICT sector regulation in SADC countries (the most recent overview is Lewis and Abrahams, 2013), though it is noted that this would be important as a foundation for outlining a medium to long term programme for African ICT sector regulators and regional regulatory associations, for policy decision-makers, for academics and innovators in the increasingly complex digital African economy.

II. BRIEF OVERVIEW OF THE SADC REGIONAL ECONOMY, ICT LANDSCAPE AND DIGITAL COMPLEXITY

An estimated 301,7 million people reside in the SADC region in 2015 (Internet World Stats, 2015; WEF, 2015), of which approximately 132 million or 44 percent had mobile subscriptions, 63 million had smartphones, 57 million or approximately 19 percent have some degree of Internet access, constituting approximately 17 percent of African Internet users (GSMA, 2015; Internet World Stats, 2015). Internet access is reported as being highest in Mauritius, The Seychelles, South Africa and Zimbabwe (47 percent or higher), while penetration is less than 10 percent in the Democratic Republic of Congo, Madagascar, Malawi and Mozambique (Internet World Stats, 2015).

In the past three decades, 1986 to 2016, African economies have transitioned from 20th century to 21st century economies, where electronic communications and the Internet are creative technologies for a cyber society, not simply general purpose technologies. The shift towards converged technologies in the audio-visual, automotive, education, entertainment, health and other spheres is creating cyber-multiverses, inhabited by both young and old, employed and unemployed, without direct discrimination on the basis of race or gender, but certainly with discrimination on the basis of income and geographic location, which have real race and gender effects. In this context, the focus of social and economic regulation of the ICT sector and of those sectors with which it is converging, as well as regulation of the converged services, presents a set of new issues for sector regulators and competition regulators alike. This paper will focus on the issues for sector regulators. It does not discuss the raging debate on the calls for regulation of OTT services, as it is important to note that there are a wide range of regulatory issues of equal or greater importance to sector development and digital transitions.

e-Services, e-business, e-content, e-transactions: The mobile money ecosystem

Electronic and mobile services are influential in the 21st century transitions in African economies. Banking operations are being transformed by Internet banking and mobile money transfers and payments, with monthly mobile money transactions in the SADC region recorded at around to USD300 million or more by December 2014. Mobile money is big in Tanzania, Zimbabwe and Botswana, with 1208, 501 and 479 mobile money accounts registered per 1000 adults in 2014.

Innovation in the mobile money ecosystem has seen the extension of services across multiple "verticals", including salary disbursements and a range of payments for education, health, e-commerce, transport, utilities, other (GSMA, 2015: 30-35). For example, the cost of intra-regional remittances is comparatively high when using the traditional banking system, noting that the average total cost of sending USD200 within Southern Africa is USD20.47 for cross-border banks and USD17.24 for other banks (African Development Bank, 2014). By contrast, the cost to the consumer of using mobile money transactions for remittances of USD200 is very low, for example Airtel tariffs in Tanzania for sending mobile money in the applicable range of 400,000 to 499,999 Tanzanian Shillings (TZS) costs only TZS1050 to send, TZS5000 to "cash out" and TZS6750 or USD3.08 to transfer to another network (Airtel, 2016). Furthermore, the African Development Report 2014 motivates for the regionalisation of retail payment systems to promote access to financial institutions, to encourage greater economic participation of SMEs and households, and to foster heightened

cross-border financial flows. This raises the issue of the importance of the mobile Internet and mobile money systems in, for example, the agricultural sector, where cross-border trade can enhance income opportunities, noting that many SADC economies (among them Malawi and Tanzania) have agricultural sectors that make a high percentage contribution to gross domestic product (GDP) (The World Bank, 2015).

Banks and financial institutions must compete and co-operate with mobile money service providers, introducing a wider range of services and engaging in practices that require regulatory attention and opening consumers of mobile money services to risks and practices that require regulated consumer protection. Mobile money and mobile financial services are not yet widespread in the region and present a significant opportunity for investment. Regulatory assurance, in particular, the promotion of interconnection of mobile money services within and across countries in the region, and the *ex ante* promotion of competition in mobile money and payments markets, would potentially stimulate interest in fostering the mobile money and mobile payments ecosystem as a means to intra-regional trade.

e-Services, e-business, e-content, e-transactions: Cloud computing[1]services and personal data in the cloud

The terrain of cyberspace is occupied by firms, groups and communities, who may be great distances apart, connected only by data held in the cyber cloud. In cyberspace, attraction and risk are interconnected and increasing distance between users of cloud services is accompanied by increasing risk. Industry practice, policy and regulation must evolve to mitigate risk and encourage greater use of innovations such as cloud services. While there are many types of cloud services, one of the most important ones from a risk perspective is the availability of personal data in the cloud, in other words the very large volumes of data held by companies and governments that are stored off site by data storage service providers, often a component of infrastructure as a service (IaaS) which includes personal data storage as a service. Firms such as banks and financial services agencies, private hospitals and clinics, internal revenue agencies and public health facilities, education departments who hold matriculation results, these and other entities requiring large personal data storage may best be served by some form of cloud service.

There are particular risks for government users of cloud services with respect to using an "external" cloud and risks associated with using an "internal" cloud. With respect to the use of the "external" cloud, this relates to risks held in common with private sector firms that hold large amounts of personal data. Legal issues associated with cloud computing include attention to ownership of information (intellectual property ownership, legal rights and obligations pertaining to confidentiality, legal rights pertaining to contractual obligations) (Reed & Cunningham, 2013, pp.142-163). A key area of law is the protection of personal data (Kuan Hon, Millard & Walden, 2013, pp.167-215), an example definition being the European Union Data Protection Directive definition (Kuan Hon, Millard & Walden, 2013, p.167):

> any information relating to an identified or identifiable natural person ('data subject'); an identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identification number or to one or more factors specific to his physical, physiological, mental, economic, cultural or social identity.

Government departments place a major emphasis on risk (senior manager interview, 2014, see Schofield & Abrahams, 2014):

> (The) perception is that if the data is kept in the cloud, who knows who accesses the data, how sure am I that everybody accesses their data only, what controls are there to ensure that individual clients only see their own data – what are the access measures and security protocols in this data storage environment. (With respect to) compliance, some government institutions are still not sure that they'll be complying with the law if the data sits in

[1] This section builds on previous research by Schofield and Abrahams (2015).

another legal jurisdiction beyond South Africa's borders. Are those systems and that infrastructure subject to the same legislative frameworks or legal provisions?

Applicable laws should deal with anonymisation of data, encryption of data, fragmentation of data, consumer protection, and will address the responsibilities of cloud providers and users.

With respect to the use of an "internal" cloud, where an external service provider creates a private cloud for government rather than storing information in a shared cloud infrastructure, risks would be associated with infringements of privacy and security of digital identities, illegal access to government data, and possibly even cyber-bullying. Innovations such as cloud computing assume a generally developmental system with respect to operational policies, legal frameworks and regulatory frameworks and practice.

e-Services, e-business, e-content, e-transactions: Internet of Things (IoT)

The ITU-T refers to the Internet of Things (IoT) as "A global infrastructure for the information society, enabling advanced services bby interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication" (Brown, 2015). Key words in the IoT glossary of terms are human-to-machine, machine-to-machine and everything-to-everything.

While the global trend for IoT deployment is reportedly greatest for smart cities, smart metering and grids, connected vehicles and healthcare (Brown, 2015), there may be similar but not identical areas of application on the African continent, a continent which has been referred to as "apps economy" (GSMA, 2015). A recent paper argues for IoT applications in Nigeria to address pressing issues such as crowd control, accident avoidance and traffic monitoring, oil pipeline monitoring, automatic reservoir systems, wildlife conservation and nomadic herding, in addition to the trending areas of smart metering and health applications, such as tracking of drugs and medical equipment (Ndubuaku & Okereafor, 2015).

e-Services, e-business, e-content, e-transactions: e-Education

e-Education is a highly content driven field, therefore also a strongly broadband driven environment. While, good statistical data is hard to access, reports indicate that approximately 17% of the 301 million regional population is at primary education level, or approximately 51 million young people. Intentions of curriculum reform and access to learning materials have been undermined by massive system failures, for example the textbook scandals in South Africa, where textbooks are never delivered to schools and/or are dumped in warehouses. Broadband policies emphasise the need for school-level access to the Internet as an important development initiative for the 21st century. However, even though the cost of WiFi Internet in a single classroom could now be less than the equivalent of ZAR99 per month, creating the total value chain of Internet in schools has been beyond the capacity of the vast majority of schools in the region. In order to advance the quality of education in the SADC region, education departments must move beyond the textbook, which is being superseded by the Internet and the new educational content that it offers access to. With greater Internet access, educational resources can be accessed anywhere, whether at school or at home, however the lack of universal access to the Internet mitigates against the use of these opportunities. There is little attention to ICT regulation to foster this form of digital economy emergence in the region – ICT in schools.

University use of the Internet is low in much of the SADC region. Despite the activities of the UbuntuNet Alliance consortium in building the African regional research and education network (RREN), which connects national research and education networks (NRENs) in 15 African countries including Malawi, Namibia and the island state of Madagascar (UbuntuNet Alliance, no date), many national NRENs have

been slow to develop due to the high costs associated with buying up and reselling bandwidth to individual institutions. Hence, innovation in education, such as massive open online courses (MOOCS, free courses that use a combination of YouTube videos, reading materials, e-tivities and peer review), online access to scholarly journals, online plagiarism checking and other resources that can enhance university education are in low levels of usage by undergraduate and postgraduate students. What is the role of regulation in fostering e-education for a digital economy, in which the quality of education produces greater human capacity for economic development?

e-Services, e-business, e-content, e-transactions: e-Health, key service for the Internet of People (IoP)

Public health is a priority field of advancement for populations, policy-makers and governments. Digital transformation in the health sphere requires work in the fields of data analytics for management of dreaded diseases such as MERS and SARS and for chronic diseases, such as tuberculosis and HIV-AIDS. The utilisation of location-based services to identify public health risks is a further field of innovation in building an Internet of People (IoP). Such innovation has individual-, family-, community- and global-level implications for public health. All these forms of Internet-based innovation in communications requires broadband infrastructure and services, still a scarce resource in public health services across the SADC region. IoP is simply a reinterpretation of IoT, with the emphasis on the effectiveness of Internet applications on people directly, not just on the processes that people use. Keywords for IoP would include people-to-people, people-to-machine-people, everything-to-people.

Article 7 of the SADC Protocol on Health advances approaches to the creation and sharing of "good quality health data" including "establishment of mechanisms for information exchange", the establishment of a regional health and social services indicators database, and the development of tele-health applications (SADC, 1999). Effectively utilising these services requires availability of Internet and broadband infrastructure in hospitals and clinics, in order to effectively communicate patient and health data on a monthly basis with a reasonable degree of accuracy and validity.

Health applications of the Internet, beyond data storage and information exchange, are at an early stage of innovation application in the SADC region. Brown (2015: 11) reports IoT applications as including "much greater use of remote telehealth provision", as well as people monitoring their own health conditions, such as diabetics monitoring their exercise patterns and healthy eating, compliance with treatment regimes, or using "connected" insulin pumps. There are significant potential cost savings in these routinised approaches that would offset the cost of moving to IoP.

e-Services, e-business, e-content, e-transactions: Universality beyond access and service

A recent report suggests that an Internet revolution is taking place on the African continent and that "the Internet could account for up to USD300 billion of Africa's annual GDP by 2015" (GSMA, 2014). However, the 2014 ITU indicators show that many SADC countries had very low levels of Internet access (2013 data), for example, 12.5 wireless broadband subscriptions per 100 inhabitants in Angola, 6.7 percent in Democratic Republic of the Congo, 4.5 percent in Cameroon, and 0.7 percent in Zambia, as compared to 74.3 percent in Botswana (ITU, 2014: Annex 3: 244-245). This data does not take account of Internet access taking place at public Internet cafes. Universality in the age of the Internet applies not only to individuals and households, but to sectors in which large numbers of people make a living through self-employment or communal forms of employment.

For the informal sector, the Internet offers the opportunity to utilize communications to enable greater access to income and, for some businesses, to transition into formal businesses. While basic street trading

may not be a typical beneficiary, some forms of informal business could take advantage more affordable mobile Internet access and mobile data services. A 2014 study in South Africa (Abrahams & Pillay, 2015) referenced the importance of the utilization of mobile communications amongst the community of waste pickers who collect household waste for resale, particularly glass and paper. Waste pickers wheel self-made bins that hold approximately 30kg of waste from the middle-class suburbs in the major cities to centralized sorting areas, and then trade with big corporate buyers for recycling. The South African Wastepickers Association aims to encourage formalisation, using mobile and Internet communications tools. The cost of communications is high in comparison to the relatively low incomes earned in this informal sector. Regulation of the cost to communicate does not take into account the realities of this and other marginal communities.

With respect to ICT in subsistence forms of agriculture, a 2013 SADC region study (Akinsanmi & Abrahams, 2013) found that ICT policies gave little attention to Internet-enabled agricultural development: "Existing agricultural related ICT initiatives such as the SADC-FANR AIMS is built around the concept of using technologies for information management via knowledge networks and the use of a wiki-platform. Participation is voluntary and as such, issues of sustainability exist and participant's priorities differ. These initiatives are rarely if at all shaped to address rural agricultural development. Such projects and information networks are therefore not meeting the needs of the larger percentage of subsistence farmers in the region who are largely located in rural areas" (Abrahams & Akinsanmi, 2013).

ICT regulation for a digital world in the SADC region and on the broader African continent needs to adopt a cross-sectoral approach, seeing not just operators and consumers, but key economic and social sectors as fields for innovative approaches to regulation. As Brown (2015) indicates, this will require regulatory attention from many regulatory institutions responsible for different regulatory functions.

III. FUTURE CHALLENGES IN SADC ICT SECTOR REGULATION FOR A COMPLEX DIGITAL WORLD

Change in a complex world involves many elements, including adaptive capacities in situations of significant lack of predictability, and experiential learning and knowledge building systems that enhance the capacity to deal with unpredictable outcomes, with respect to the key social and economic institutions. It has been argued that the broad African economy is growing in size, but not sufficiently in depth, or complexity, or in the enhancement of "the technical capabilities of people and institutions" (African Center for Economic Transformation, 2013), required for transforming from mainly agricultural or services-based economies to technology-oriented agri-industrial economies, or techno-services-based economies, or knowledge-based economies.

The growing importance of advanced policy, law and regulation

Sector reform in the telecoms and broadcast sectors has moved slowly across the 15 countries in the SADC region. In many, but not all countries, regulation has fostered partial competition, with many markets incorporating one fixed fixed and two or more mobile operators (Lewis & Abrahams, 2013) and with effective mobile substitution in all markets. A recent paper argued that the reforms that have occurred on the African continent may not be a sufficient foundation for digital transformation of important economic sectors (Abrahams, 2015):

> Policy, law and regulation are important in influencing the speed of change, the reality and rapidity of e-transformation...Competition in telecoms and Internet markets has been only partially successful and the pricing of telecoms and Internet services has mitigated against greater access and usage for large numbers of the population, meaning that African cyberspace is sparsely populated…To make future economic growth both possible and actual,

> cyberspace and real-time space will need to link up and adapt to each other. In so doing, policy, law and regulation will have to be written and rewritten many times, in order to adapt to the rapid changes that ever new digital technologies are bringing, suitably written for the country context, but sufficiently open to enable regional economic integration.

In a discussion paper for the Global Symposium for Regulators (Brown, 2015), the author advises the need for the ICT regulatory community to become familiar with the implications of IoT (Brown, 2015: 5):

> examining the challenges and opportunities to understand how this is impacting consumers, businesses, governments and society at large. There are particular regulatory implications for licensing and spectrum management, switching and roaming, addressing and numbering, competition, security and privacy – some familiar to telecoms regulators, and other areas where different regulators typically take a lead.

Economic and social regulation in the mobile money and mobile payments ecosystem

The regulation of mobile money and mobile payments in the market places created in cyberspace is at an early stage of development. Among the issues requiring the attention of regulators is the interconnection of mobile money services within countries and the cross-border regulation of remittances and money transfers. In terms of Directive #24 of the Central Bank of the Democratic Republic of Congo, the banking regulator, "Prior to performing any electronic money activity, electronic money institutions, as defined in the Directive, must be approved by the Central Bank" (Di Castri, 2014).

Detailed investigation is required to advance consumer protection in these cyber environments and to attract more participants to the cyber economy. A specialist consumer protection regulator may be in existence to govern consumer protection issues, where there may be overlapping responsibilities with the banking regulator and with the electronic communications sector regulator. This three-way overlap has not yet been anticipated or experienced in the SADC region countries. While co-jurisdiction between the general competition regulator and the electronic communications sector regulator is still in its infancy, new forms of concurrent jurisdiction are already on the horizon demanding attention and increasing the levels of complexity that individual regulators are required to deal with.

Economic and social regulation in cloud computing environments

With respect to consumer protection for cloud related services (Cunningham & Reed, 2013, pp.331-360), laws can provide for *ex ante* or *ex post* protection. *Ex ante* protection applies where law and/or the relevant regulator(s) set the requirements with which the contracting must comply, which may include restrictions on how the applicable information is stored, used or distributed. For example, the Protection of Personal Information Act (RSA, 2013) [the POPI Act] provides for protections related to "processing of special personal information", including authorisations concerning the data subject's religious or philosophical beliefs, race or ethnic origin, trade union membership, political persuasion, health or sex life, criminal behavior or biometric information, as well as measures related to the processing of personal information of children (RSA, 2013: sections 26-35).

The POPI Act introduces a new regulator, the Information Regulator (RSA, 2013: sections 39-56), whose functions include monitoring and enforcing compliance with the Act by public and private bodies; doing research and monitoring technology advancement (read cloud services) to ensure that any adverse effects on the protection of personal information of data subjects is minimized; conducting an assessment of a public or private body with respect to processing of personal information to consider compliance with the conditions for the lawful processing of personal information. Forms of *ex ante* consumer protection include codes of practice, provided for in terms of POPI Act sections 60 to 68. *Ex post* protection applies where a

party seeks to remedy a breach in a contractual arrangement or non-compliance with applicable laws or regulations, provided for in terms of POPI Act sections 74 to 99, addressing a wide range of issues including settlement of complaints and civil remedies. Such consumer protection and protection of personal information arrangements are new terrain for service providers and consumers and the realities of compliance and enforcement have not yet been tested by regulators in any significant way.

No clarity has yet been sought or obtained on matters of possible co-jurisdiction between the consumer protection regulator, the information regulator (personal data) and the electronic communications sector regulator, or forum shopping across regulators with respect to complaints by the public.

Regulating the Internet of Things: The agenda for national regulatory agencies and CRASA

A summary of the key IoT regulatory issues (Brown, 2015: 19-20), which will need to be investigated further in the SADC regional environment, and which will require a regional regulatory discussion paper from CRASA, include spectrum licensing and management to ensure available spectrum for the growing range of IoT applications and uses; switching and roaming billing and management for machine-to-machine uses; adressing and numbering for "globally addressable things"; competition regulation to withstand the potential for consumer lock-in and to address cases of abuse of dominance; privacy, security and cybercrime. IoT applications and uses are deployed across platforms such as cloud computing and mobile payments systems, thus the effective evolution and formation of IoT in the SADC region will require attention to a series of connected regulatory agendas and measures, within a single regulator and across multiple regulators.

Regulating to foster e-education

Hernandez, Leza and Ballot-Lena (2010: 17-20) motivate for allocating spectrum and/or utilising unlicensed spectrum for "educational broadband". They do not specify any particular regulatory approach. The assignment of TV white spaces, the spaces between bands in the broadcast frequency range, for educational broadband would meet these requirements.

South Africa has been exploring new approaches to providing broadband connectivity to schools, of which the following is of interest here. The institution providing dedicated broadband capacity to universities and research institutions, the Tertiary Education Network (TENET) has commenced offering connectivity to schools, with 5 initial service delivery points through the e-Schools network. TENET and the CSIR were engaged in TV white space (TVWS) trials in Cape Town in 2013 and in Limpopo province in 2014. Key findings include (Carlson, Ntlatlapa, King, Mgwili-Sibanda, Hart, Geerdts & Song, no date: 7):

(i) reliable and fast broadband services up to 12 mbps[2] at a distance of up to 6.5km[3];

(ii) a suitably designed geolocation database enables the avoidance of harmful interference with licensed services;

(iii) availability of significant vacant TVWS spectrum for use.

Regulation of TVWS will require attention to designation or allocation of frequency bands for white space devices (WSDs), spectrum sensing approaches, utilisation geolocation databases, designation of suitable geolocation database administrator, technical specifications such as maximum transmit power levels, and other regulatory issues. The opportunities offered by the next phase of the digital-innovation age increases the importance of all forms of regulation, but challenges regulators with high levels of complexity.

Regulating to foster e-health

Many regulatory issues arise for electronic communications regulators and for health regulators, including issues of storage of personal health data in the cloud, sharing of health information that is anonymised, privacy and trust. Research is required into those issues that require independent regulation and those issues that require self-regulation and what combination of independent and self-regulation is most appropriate. It is necessary to conduct research into the strengths and weaknesses of the current regulatory environments for public health and electronic communications, to understand where regulations may be in contradiction to each other, or where regulations may create barriers to digital transformation of the public health sector, to extending this important form of the social use of the Internet. It is also necessary to gain clarity on matters that may require concurrent jurisdiction by the health professions regulator and the electronic communications sector regulator, in order to create an enabling environment for consumer welfare.

Regulating to foster universality

Without universal access and service to all things Internet, much of the promise of the Internet-innovation age will be meaningless to several billion people across the planet and to significantly more than half the population in the SADC region. Thus, regulation for universal access and service will need to greatly encourage mobile access and service, mobile broadband access and service, mobile money and mobile payments access and services, IoT and IoP services and consumer protections, as well as the underlying platforms such as cloud computing governance and risk. Regulating for universality in the 21st century now requires embedding multiple sets of cross-cutting regulations, a necessary feature of Internet-enabled commerce, trade and social networking.

Cybersecurity, cybercrime and cyber-warfare

Cyber-crime and cyber-security and possible cyber-warfare, sometimes referred to as the "deep web", are challenges that cannot be evaded. Small, micro and medium enterprises are particularly at risk of security breaches (Hutchings, Smith & James, 2013). Existing legal definitions of cyber-crime, regulatory measures for monitoring cyber-crime and penalties for criminal activity occurring in cyberspace, require review and possible enhancement. A few countries, in particular South Africa in the SADC region, have introduced new draft legislation to address these matters (Parliament RSA, 2015). Existing legislation, the Electronic Communications and Transactions Act (RSA, 2002), made provision for the appointment and powers of cyber-inspectors and the definition of and penalties for cybercrime, but required an overhaul in light of the innovations in cyber-crime activities. The 2015 discussion document and draft legislation on cybercrime includes the objectives (RSA, 2015):

> to create offences and impose penalties which have a bearing on cybercrime; to further regulate jurisdiction of the courts; to further regulate the powers to investigate, search and access or seize; to further regulate aspects of international cooperation in respect of the investigation of cybercrime; to provide for the establishment of a 24/7 Point of Contact; to provide for the establishment of various structures to deal with cyber security.

Given the complexity of managing the environment of criminal conduct in cyber space and the need for new knowledge resources to build and argue cases in courts of law, the SADC region needs legal practitioners knowledgeable in cyberspace studies, and African research cyberspace must become an established field of enquiry, as well as a field of academic and legal practice.

Ethics and self-regulation in cyberspace

This paper has attempted to illustrate the regulatory parameters of cyberspace. While regulation is necessary, self-regulation is an important field of exploration for policy-makers and regulators, in order to encourage greater self-regulation amongst service providers, with respect to activities of minimum risk or areas where self-regulation would remove an unnecessary burden on regulators. Where possible, user communities and provider communities can create and sign up to applicable codes of conduct, while regulators can also publish codes of conduct and monitor compliance, which is less onerous than direct regulation.

IV. CONCLUDING REMARKS: REORIENTING POLICY AND REGULATION FOR THE SADC DIGITAL ECONOMY

This brief review sought to introduce a discussion on regulation within a complex digital world, with respect to the SADC region. Over the remainder of the 21st century, deep structural economic change is inevitable, even where this may be due to exogenous influences. As argued in a previous paper (Abrahams, 2015), regulators must confront rather than shy away from the complexity enshrined in the digital future. Three short concluding comments are offered here: (i) with respect to regulatory harmonization of cyber space across the SADC region; (ii) with respect to concurrent jurisdiction of regulators; and (iii) with respect to academic and industry research on the SADC region.

The regulation of cyberspace and regulatory harmonisation across the SADC region

Historically, key areas of regulatory attention in the SADC region have focused on interconnection rate regulation, licensing of radio frequency spectrum, broadcast digital migration, competition matters, and consumer protection, amongst others. Future topics for regulatory harmonisation include cyberspace risk and governance, mobile money and mobile payments, cloud computing, Internet of Things and Internet of People. While regulation in the first decade of the 21st century was relatively demanding, these listed fields of enquiry are even more resource-intensive fields of regulation. This presents a significant role for the regional regulatory association, CRASA, to formulate "model" laws, codes and regulatory guidelines for the relatively under-resourced national regulators in the region.

Concurrent jurisdiction of regulators

Concurrent jurisdiction between the electronic communications sector regulator and the general competition regulator has been practiced in many jurisdictions for more than a decade. *Ex-ante* guidance to firms by the sector regulator has assisted in fostering partial competition, while complaints are dealt with *ex-post* by the general competition regulator. Forum shopping by fixed and mobile operators has been used to delay regulatory decisions, but has become less frequent as the market has settled. Mobile money and mobile payments systems have introduced new complexities (read unpredictability and uncertainty), as the banking and financial services regulators have an interest in the regulation of mobile money, creating the opportunity for a "three-ring circus" amongst the banking/finance, consumer protection and ICT regulators. With the evolution of IoT, more regulators will enter a common or interconnected space.

Regulators participating in the 21st century cyber space will include general regulators, such as competition regulators, consumer protection regulators and personal data "information" regulators, whose functions are not sector specific, and sector specific regulators, such as electronic communications sector regulators, banking and financial regulators, health professions regulators, and others, possibly also transport regulators. Some matters will be clearly attributable to the mandate of a particular regulator, other matters will fall in the overlapping mandates across regulators, before matters become clearly addressable by one or another. In the initial period, there is likely to be significant forum shopping across

regulators, until regulatory positions are clarified, regulations are drafted, memoranda of agreement are signed and implemented.

Building academic and industry research on policy and regulation for SADC cyberspace

In the contemporary technology and regulatory era, regulators in the SADC region will make use of research texts and contributions from many sources outside the region, including ITU research and regulatory position papers from some of the key regulators across the world. For the electronic communications sector, this will include papers published by the Federal Communications Commission (US), Ofcom (UK), the TRAI (India) and others. The ITU characteristically draws on academics to prepare position papers for the Global Symposium for Regulators and other ITU events. Industry research is growing in volume and in value to industry. Researchers and academics in the SADC region must similarly engage and be engaged in public interest research, including endeavors to create and publish knowledge for the regional regulatory association, CRASA and for the 15 national regulators, in order to advance the state of regulation in the SADC region.

REFERENCES

Abrahams, L. (2015). Framing the digital complexity economy. IEEE: 2015 International Conference on Cyberspace (CYBER-Abuja), Abuja, 4 – 7 November 2015, pp.i-vii, DOI: 10.1109/CYBER-Abuja.2015.7360506

Abrahams, L. & Pillay, K. (2015). *The lived costs of communications: Experiencing the lived cost of mobile communications in low and very low income households in urban South Africa*. Johannesburg: R2K and LINK Centre.

African Center for Economic Transformation. (2013). *Growing rapidly – transforming slowly: Preview of the 2013 African Transformation Report*. Accra, Ghana: African Center for Economic Transformation [ACET].

African Development Bank. (2014). *African development report 2014: Regional integration for inclusive growth*. Tunis: African Development Bank. Retrieved from http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/ADR14_ENGLISH_web.pdf

Akinsanmi, T. & Abrahams, L. (2013). Developing a framework for a community informatics policy network: Agriculture for rural development in Southern Africa, Johannesburg: LINK Centre, Report prepared for NEPAD, 2013.

Boylaud, O. & Nicoletti, G. (2001). *Regulation, market structure and performance in telecommunications*. Organisation for Economic Co-operation and Development (OECD) Economics Department Working Papers, No. 237. Paris: OECD Publishing. Retrieved from http://dx.doi.org/10.1787/601531871521

Bourreau, M. & Dogan, P. (2004). Service-based vs. facility-based competition in local access networks. *Information Economics and Policy, 16*(2), 287-306. Retrieved from http://dx.doi.org/10.1016/j.infoecopol.2003.05.002

Brown, I. (2015). *Regulation and the Internet of Things*. Discussion paper for the Global Symposium for Regulators. Geneva: ITU. Retrieved from https://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2015/Discussion_papers_and_Presentations/GSR_DiscussionPaper_IoT.pdf

Buigues, P. (2006). Competition policy versus sector-specific regulation in network industries: The EU experience. Submitted to UNCTAD's 7th Session of the Intergovernmental Group of Experts on Competition Law and Policy. Geneva: UNCTAD. Retrieved from http://unctad.org/sections/wcmu/docs/c2clp_ige7p14_en.pdf

Carlson, J., Ntlatlapa, N., King, J., Mgwili-Sibanda, F., Hart, A., Geerdts, C., & Song, S. (no date a). Studies on the use of television white spaces in South Africa: Recommendations and learnings from the Cape Town television white spaces trial. Retrieved from http://www.tenet.ac.za/tvws/recommendations-and-learnings-from-the-cape-town-tv-white-spaces-trial

Carlson, J., Ntlatlapa, N., King, J., Mgwili-Sibanda, F., Hart, A., Geerdts, C., & Song, S. (no date b). Annexure G: Suggested technical rules and regulations for the use of TVWS and managed access spectrum. Retrieved from http://www.tenet.ac.za/tvws/suggested-technical-rules-and-regulations-for-the-use-of-tvws-and-managed-access-spectrum

Czernich, N., Falck, O., Kretschmer, T., & Woessman, L. (2011). Broadband infrastructure and economic growth. *The Economic Journal, 121*(552), pp.505-532. DOI: 10.1111/j.1468-0297.2011.02420.x

Cunningham, A. & Reed, C. (2013). Consumer protection in cloud environments. In Millard, C. (Ed.) *Cloud computing law,* pp.331-360. Oxford, UK: Oxford University Press.

Di Castri, S. (2014). *Enabling mobile money policies in the Democratic Republic of Congo*. London: GSMA. Retrieved from http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/04/Enabling-Mobile-Money-Policies-in-the-Democratic-Republic-Of-Congo.pdf

Etro, F. (2011). The economics of cloud computing. *The IUP Journal of Managerial Economics, 9*(2), pp.1-16. Retrieved from http://www.chinacloud.cn/upload/2012-05/12050307542670.pdf

Fransman, M. (2007). *The new ICT ecosystem: Implications for policy and regulation*. Cambridge, UK: Cambridge University Press.

Fredebeul-Krein, M. & Freytag, A. (1999). The case for a more binding WTO agreement on regulatory principles in telecommunications markets. *Telecommunications Policy, 23*(9) 625-644. DOI: 10.1016/S0308-5961(99)00047-6

Gebreab, F. (2002). *Getting connected: Competition and diffusion in African mobile telecommunications markets*. Policy research working paper no. 2863, Washington D.C., US: The World Bank. Retrieved from http://hdl.handle.net/10986/14261

Gillwald, A. (2005). Good intentions, poor outcomes: Telecommunications reform in South Africa. *Telecommunications Policy, 29*(7), pp. 469-491. Available at http://www.sciencedirect.com/science/article/pii/s0308596105000467

GSMA. (2014a). *The mobile economy: Sub-Saharan Africa 2014*. London: GSMA. Retrieved from http://www.gsmamobileeconomyafrica.com/GSMA_ME_SubSaharanAfrica_Web_Singles.pdf

GSMA. (2014b). *Digital inclusion*. London: GSMA. Retrieved from http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/11/GSMA_Digital-Inclusion-Report_Web_Singles_2.pdf

GSMA. (2015). *The mobile economy: Sub-Saharan Africa 2015*. London: GSMA. Retrieved from https://gsmaintelligence.com/research/?file=721eb3d4b80a36451202d0473b3c4a63&download

Hanna, N. & Summer, R. (2015). *Transforming to a networked society: Guide for policy makers*. Maryland: Sriban Books.

Haucap, J. (2003). *The economics of mobile telephone regulation*. Discussion paper no. 4., Department of Economics, University of the Federal Armed Forces, Hamburg, Germany. Available at http://www.hsu-hh.de/download-1.5.1.php?brick_id=xlx9yAvk9tT6DYqd

Hernandez, J., Leza, D., & Ballot-Lena, K. (2010). *ICT regulation in the digital economy*. Discussion paper for the Global Symposium for Regulators. Geneva: ITU. Retrieved from https://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR10/documents/GSR10-ppt2.pdf

Hinde, C. & van Belle, J-P. (2012). Cloud computing in South African SMMEs: Risks and rewards for playing at altitude. *International Research Journal of Computer Science Engineering and Applications, 1*(1), pp. 32-41. Available at http://www.academia.edu/3036522/Cloud_Computing_in_South_African_SMMEs_Risks_and_Rewards_for_Playing_at_Altitude

Hutchings, A., Smith,R., & James, L. (2013). *Cloud computing for small business: Criminal and security threats and prevention measures*. Trends & issues in crime and criminal justice no. 456. Canberra, Australia: Australian Institute of Criminology. Retrieved from http://www.aic.gov.au/media_library/publications/tandi_pdf/tandi456.pdf

Kelly, T., Mulas, V., Raja, S., Qiang, C., & Williams, M. (2009, September). *What role should governments play in broadband development?* Paper prepared for infoDev/OECD workshop on "Policy Coherence in ICT for Development", Paris, 10-11 September. Retrieved from http://www.oecd.org/ict/4d/43631862.pdf

Internet Society. (2015). *Global Internet report 2015: Mobile evolution and development of the Internet*. Retrieved from http://www.internetsociety.org/globalinternetreport/assets/download/IS_web.pdf

ITU. (2014). *Measuring the information society report 2014*. Geneva: International Telecommunication Union [ITU]. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf

ITU. (2015). *Measuring the information society report 2015*. Geneva: International Telecommunication Union [ITU]. Retrieved from http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf

Lewis, C. & Abrahams, L. (2013). *The SADC communications environment: An assessment of communications policies, laws and regulation in SADC member states*. Johannesburg: LINK Centre. Report prepared for the SADC Secretariat with respect to the Strengthening of Economic and Trade Related Capacities and Competences in SADC, 2013. Available at https://www.wits.ac.za/media/migration/files/SADCCommsEnvironmtAssessmtdigitaleconomies.pdf

Maaref, S. (2012). *Cloud computing in Africa: Situation and perspectives*. Geneva: International Telecommunication Union [ITU]. Retrieved from http://www.itu.int/ITU-D/treg/publications/Cloud_Computing_Afrique-e.pdf

Nanevie, F. (2012). *The effects of government regulations on the mobile communication telephony in Ghana*. MBA thesis, Institute of Distance Learning, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. Retrieved from http://ir.knust.edu.gh/bitstream/123456789/4331/1/Frederick%20A.%20Nanevie.pdf

Ndubuaku, M. & Okereafor, D. (2015). State of Internet of Things deployment in Africa and its future: The Nigerian scenario. *The African Journal of Information and Communication, 15*, pp. 114-119. Available at http://wiredspace.wits.ac.za/handle/10539/19269

Noll, R. (1999). *Telecommunications reform in developing countries*. Working paper 99-10. AEI-Brookings Joint Center for Regulatory Studies. Available at http://papers.ssrn.com/abstract=181030

Millard, C. (Ed.) (2013). *Cloud computing law*. Oxford, UK: Oxford University Press.

Parliament RSA. (2015). Cybersecurity and Cybercrimes Bill, Draft for Public Comment. Retrieved from http://www.justice.gov.za/legislation/invitations/CyberCrimesBill2015.pdf

Reed, C. & Cunningham, A. (2013). Ownership of information in clouds. In Millard, C. (Ed.) *Cloud computing law*, pp.142-163. Oxford, UK: Oxford University Press.

RSA (2013). Protection of personal information Act No. 4 of 2013. Government Gazette No. 37067. Retrieved from http://www.justice.gov.za/legislation/acts/2013-004.pdf

SADC Secretariat. (1999). Protocol on health in the Southern African Development Community. Retrieved from http://www.sadc.int/files/7413/5292/8365/Protocol_on_Health1999.pdf

Schofield, A. (2014). Research study on the economic impact of cloud services on South African SMMEs. Johannesburg: JCSE, University of the Witwatersrand. Retrieved from http://www.jcse.org.za/sites/default/files/%5Bfilename%5D_0.pdf

Schofield, A. & Abrahams, L. (2015). Research study on the use of cloud services in the South African government. Johannesburg: JCSE and LINK Centre, University of the Witwatersrand. Available at https://www.wits.ac.za/media/migration/files/JCSE%20LINK%20Cloud%20in%20Govt%20research%20paper%20V21.pdf

UbuntuNet Alliance. (no date). Member NRENs. Retrieved from https://www.ubuntunet.net/members

WEF. (2015). *The Africa competitiveness report 2015*. Geneva: World Economic Forum. Retrieved from http://www3.weforum.org/docs/WEF_ACR_2015/Africa_Competitiveness_Report_2015.pdf

World Internet Stats. (2015). Internet usage statistics for Africa, 2015. Retrieved from http://www.internetworldstats.com/stats.htm