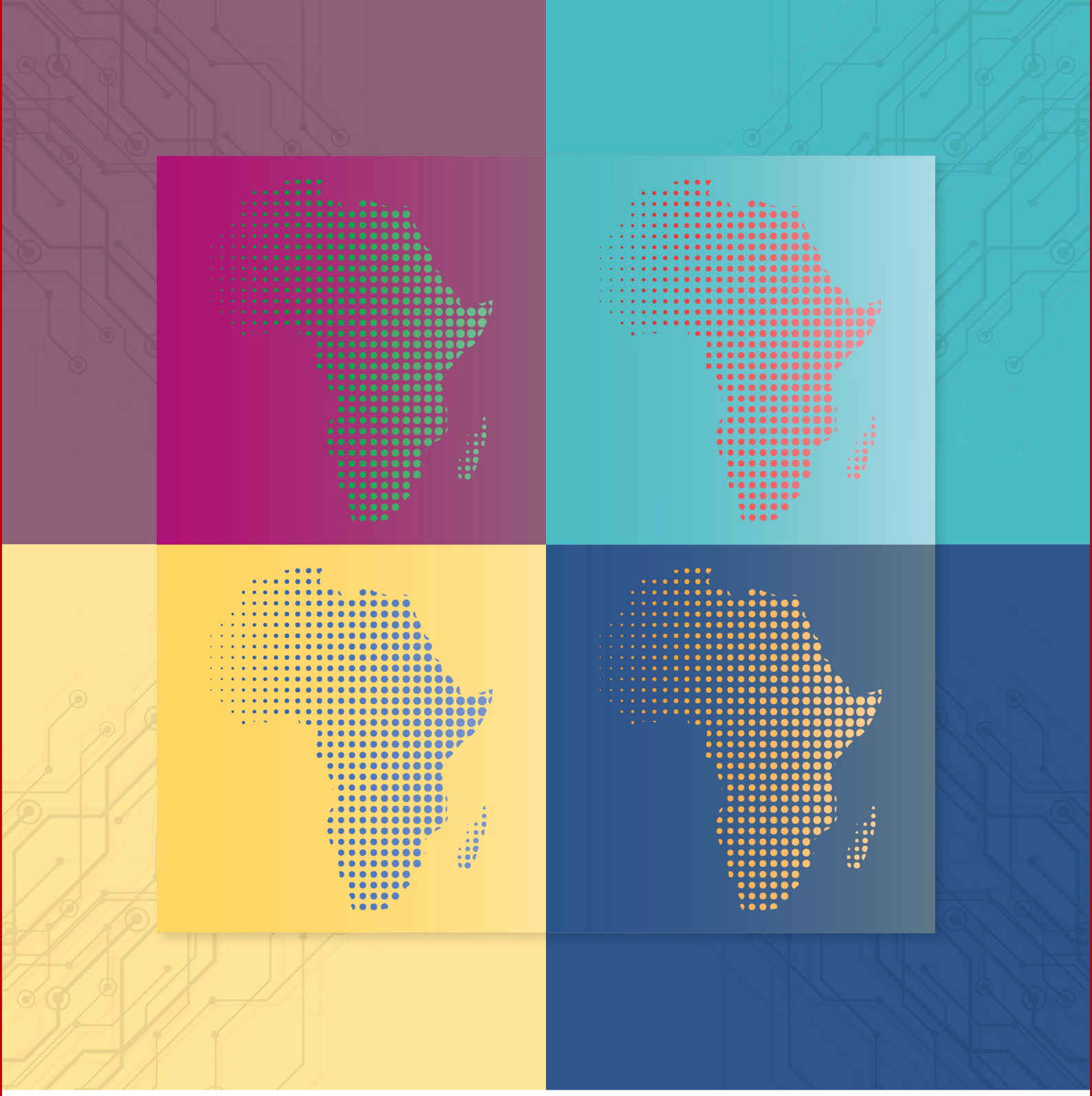

Digital Policy Studies

Digital Policy Studies is an open-access, peer-reviewed interdisciplinary academic journal focused on the empirical, critical and intersectoral study of subjects related to digital policy and the fourth industrial revolution, cybersecurity, the digitalisation of politics, the digital economy, information and communication technology, the convergence of technology and society, new media and related topics. The Journal publishes research articles, review articles and policy commentary in designated sections.

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Introduction to *Digital Policy Studies*

Bhaso Ndzendze
Editor in Chief: DPS and
Head of Unit, 4IR and Digital Policy Research Unit (4DPRU),
University of Johannesburg
bndzendze@uj.ac.za

All over the world, governments, intergovernmental organisations, citizens and businesses are simultaneously driving, coping with and grasping the reality of digitalisation. They have promulgated new legislation, published plans, and put out strategies to pursue their brand of accelerated or perpetual development with the aid of electronic equipment and software for communications and cyber-physical execution. These entities have also used technologies to regulate, circumvent and/or contest one another. In the wake of these realities, new concepts have been introduced in the literature and the practitioner's manuals and the citizen's everyday lexicon. From agriculture to banking, culture, diplomacy, electric grids, finance, governance, human rights, international trade, and journalism, technologies are pushing the frontier of what was previously possible. With new capabilities and the proliferation of technologies such as artificial intelligence, big data, blockchain, and quantum computing, the process is receiving a significant jolt. Importantly, however, the benefits (convenient and efficient access to goods, services, information and ideas) are not even or universal. Neither are the side effects (climate change, exclusion, and e-waste, among others). Geographical, economic, and other realities reinforce old divides and give rise to new ones. But there are also instances of the gap being closed.

In recognition of this, several conversations with leading scholars and leaders in business and government throughout 2021 made it increasingly evident that a specialist journal was necessary. Its role would be simple: to house the latest research and thought leadership on the intersection of digital technologies and the world of politics and policymaking. The principal aim of this journal – *Digital Policy Studies* (*DPS*) – is to be a platform for thoroughgoing, empirical and groundbreaking research that tells the stories of how technologies come about, are accessed, experienced and disposed of. Within and between these stages are layers of complexity, bringing together notions of ideas, power, and consumption. These are simultaneously the currency of the educationalist, the engineer, the environmentalist, the legal scholar, the political economist and scientist, the sociologist, and many others from the various domains of inquiry.

Moreover, the activity patterns can be understood with a litany of methods. Thus, this journal's policy is to be multidisciplinary (as shown so clearly by the eclecticism of the papers in the current issue) and openly accessible. Herein lies the niche of this journal, then, as it seeks to be the companion of the academic, the policymaker, and the student, and to be the propagator of a consolidated new field of study and specialisation: Digital Policy Studies.

This volume is indebted to the incredible generosity of various persons who have been very giving of their ideas, time and resources. I wish to thank them here in turn. For their support and direction in the formulation of the new journal when it was still only an idea, I am grateful to Professor Tshilidzi Marwala, Professor Siphamandla Zondi, Dr Andile Ngcaba, Professor Sarah Chiumbu, Juanita Clark, Dr Olumide Abimbola, Faten Aggad, Professor Timothy

Shaw, Professor David Hornsby, Professor Messay Mulugeta, Dr Bob Wekesa, and Professor Annie Chikwanha. For their incredible energy and thoroughness in putting together the first issue, I wish to thank Dr Tinuade Ojo, our managing editor, Riaan de Villiers, copyeditor, and Dr Emmanuel Matambo, our book reviews editor and our editorial assistants, Zimkhitha Manyana, Johannes Mancha Sekgololo and Gift Sonkqayi. I am immensely grateful to the incredible team at the UJ Press, especially for the wonderful guidance of Wikus van Zyl, Alrina de Bruyn, and Reneka Panday. The articles went through numerous stages of peer review, and the efforts of the reviewers and the team at the 4IR and Digital Policy Research Unit (4DPRU) at the University of Johannesburg were indispensable in that process.

I want to especially thank and recognise the contributors to this inaugural issue of this inaugural volume. We are excited to be already working with scores of talented scholars on subsequent special issues which will come out under the next volume. Thank you all for entrusting us with your ideas and findings.

RESEARCH ARTICLES

Technology and welfare

Investigating the relationship between the ownership of technology-based assets and subjective measures of human well-being

Alexander C O'Riordan
Stellenbosch University
alexcoriordan@gmail.com

Abstract

The relationship between technology and individual welfare is not well understood, and as we progress into a future in which technology invades almost every aspect of life, the importance of this relationship must be recognised and an improved understanding reached. In this study, we attempt to lay a foundation for such an understanding. Using an approach based on Sen's theory of Capabilities and the South African National Income Dynamic Survey (NIDS), it estimates the effects of the ownership of technological assets on self-reported measures of well-being, both subjective and objective. Any empirical analysis of this relationship needs to control for several confounding factors. The estimation procedure employed is based on a dynamic panel approach, one that is capable of controlling for individual effects, as well as potential sources of endogeneity such as reverse causality. The results indicate that there is a statistically significant relationship between changes in the composition and value of one's technological asset portfolio and measures of social and economic well-being. Specifically, they show that increased ownership of technological assets improves one's overall life satisfaction and health status, but has little effect on one's positivity about the future. This study has found evidence that technology can improve lives when controlling for confounders such as increased wealth and status. Future work can improve upon this by better understanding the dynamics of this relationship, and disaggregating further by type of technology.

Introduction

Human well-being is a highly complex social construct, one that is based fundamentally on an intricate amalgam of factors. Unfortunately, economists have generally ignored its nuances in favour of simplified assumptions based on our modelled understanding of what is theoretically rational human behaviour. The central concept upon which much of our work is based -- utility -- has been used in an almost ignorant manner as the only real end of human pursuit. This simplified approach does not stand up to the elaborate nature of human well-being; the approach of treating well-being as an objective and definable construct is not appropriate. As elucidated above, well-being is multi-dimensional; as such, any empirical analysis will need to account for its many facets. The current analysis employs an approach first introduced by Sen (1985), which posits that the social and economic capabilities of individuals determine the extent to which they can participate in the economy, and ultimately derive welfare and utility.

This approach in itself does not incorporate multiple dimensions; however, it can be applied to a plethora of distinct situations. This idea serves as the point of departure for this study, which seeks to improve our understanding of the relationship between access to and the use of technology and one's subjective well-being.

The act of empirically analysing the effect of access to and use of technology is an econometric endeavour with much promise. Moreover, combining this analytical effort with a well-defined and slightly augmented theory of human capabilities presents a productive means of bettering our understanding of human behaviour within this domain. It is here where the current study finds purpose. The capabilities approach forms the foundation of the research question which guides the current study: Does the ownership of technological assets improve subjective measures of well-being? It is here explicitly assumed that capabilities are positively correlated with subjective measures of wellbeing. Therefore, it is the purpose of the current study to derive accurate estimates for the effect of technology on the capabilities of South African individuals.

Achieving such estimates is an empirical challenge, one fraught with sources of bias and unobservable heterogeneity. There exists a number of methods that theoretically can reduce the prevalence of endogeneity in cross-sectional estimates, such as selection adjustment models, propensity score matching, and instrumental variable estimates. However, these approaches require arbitrary distributional and exclusionary assumptions which are not ideal, and that can themselves generate weak estimates if poorly specified (Casale & Posel 2011). In an attempt to overcome the shortcomings of cross-sectional estimates, the current study uses panel data and dynamic Generalised Method of Moments estimators.

The study is structured as follows. First, the theoretical framework upon which the empirical strategy is based is defined. Second, the data is introduced and described. Third, the empirical results are presented and primary findings are discussed. Finally, conclusions are provided.

Theoretical framework

As mentioned in the introduction, the foundation upon which the empirical analysis is to be applied is based on Sen's (1985) capabilities approach. This section outlines the basics of this approach in a manner that is augmented to align with the purpose of the current study. Figure 1 outlines the basic structure of Sen's original approach.

Source: Clark & Qizilbash (2005)

Figure 1: A diagram of Sen's capability approach

This diagram visually describes the interaction through which an individual has control over some scarce and economically useful commodity. This enables the individual to perform some productive function. However, one must note the necessary distinction between the ability to perform some function and the actual act of performing that function. In short, an individual must put this commodity to use and actively perform some function in order to derive utility.

Therefore, utility is an increasing function of functions, which are themselves a function of control over assets. Utility then, is indirectly an increasing function of commodities.

This study uses an augmented version of the above framework that introduces and emphasises access to and the use of technology-based assets. The concept of functioning is decomposed into a number of distinct types. Specifically, the study focuses on the effect of technology on self-reported life satisfaction, measures of individual health, employment status, and individual expectations about social status in the future. The main reason behind the need for a capabilities approach is that people are extremely heterogeous; hence, no single utility function that maps asset ownership and actions onto utility should be sufficient to model human behaviour. Moreover, there is an intuitively appealing relationship between the command over technology-based assets and the ability to benefit from the use of these assets in an economically and socially productive manner. Therefore, from both a technical and intuitive perspective, the capabilities approach is ideal. The following provides a formal description of the theoretical framework (Clark & Qizilbash 2005).

Technological assets have an instrumental value in that they enable certain functions. A function is something achievable by an individual, something an individual is capable of doing (and does do) in order to derive utility. Here, commodities refer to technological assets, and command refers to either ownership of or access to these technological assets.

First, let x_i be a vector of commodities commanded by individual i, and $g_i(x_i)$ be a mapping that converts these commodities into functions. That is, the commodities owned by individual i create some ability with which individual i uses x_i to perform some function in a manner distinct from individual . In this way, the capabilities approach allows for heterogeneity between individuals. Individuals differ in the extent to which they make productive use of commodities, certain individuals may make better use of commodities than others. Moreover, let f_i represent the utility mapping function of individual i. The use of this mapping function implies that individual i will purposefully use his or her commodities in order to reach state s_i because it results in utility. This utility function maps x_i onto s_i in the following manner:

$$s_i = f_i(g_i(x_i))$$

Where s_i refers to the vector of states that an individual can attain given his or her commodity vector. In the current study, this s_i vector can include states such as currently searching for a job, being employed, being healthy, or positive feelings about future prospects. In this same vein, examples of functions can be the ability to search for a job effectively using the internet or a wider social network enabled by ownership of a mobile phone, gaining a better understanding of health concerns via online communication, or having access to education opportunities through the use of technology. The set of capabilities available to an individual can be summarised by the following:

$$C_i = [\, s_i \mid s_i = f_i(g_i(x_i)), \quad \forall f_i \in F_i \text{ and } x_i \in X_i \,]$$

Where C_i denotes the vector of capabilities for individual i. From the above, capabilities available to individual i are represented by all possible states, given that the states are feasible (attainable) with regard to their command over commodities. Moreover, this vector of capabilities exists for all possible utility mappings within the set of utility mappings of individual i, and all possible commodity vectors available to individual i. Put simply, we

observe individual i with a specific vector of commodities (x_i), and a specific mapping (f_i) of commodities onto states s_i. However, these observable characteristics need not have been the specific ones observed: it is theoretically possible that individual i may have possessed any vector of commodities within the set X_i, and any mapping within the set F_i. Therefore, the above formulation allows for a certain level of generality. Finally, the ultimate utility that individual i derives can be represented by the function below, in which ε_i is a vector that captures all other determinants of utility not related to the capabilities of individual i.

$$U_i(C_i) = \precsim_i (C_i, \varepsilon_i)$$

This formula is succinctly summarised in Figure 2.

Figure 2: Diagram of the theoretical framework employed in the current study

Empirical methodology and data

Identification and estimation

As mentioned in the introduction, any empirical study based on asset ownership and subjective well-being is subject to endogeneity. The main sources of this endogeneity are simultaneity and the possibility for reverse causality. That is, the exact direction of causality in not necessarily known *a priori* – Figure 3 outlines the multiple possible directions of effect.

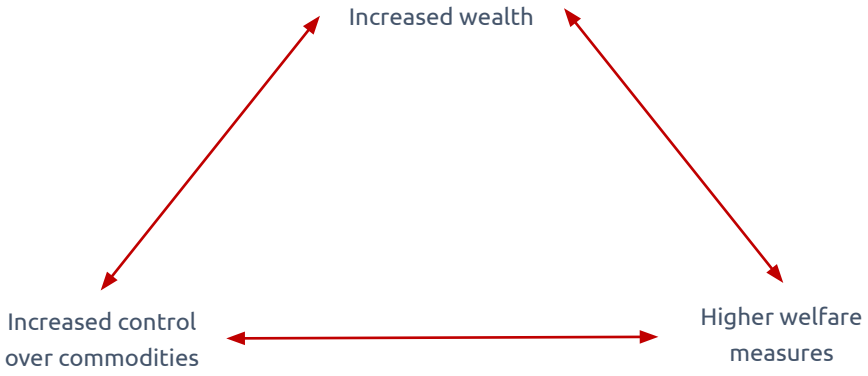

Figure 3: Diagram of the possible directions of cause and effect

The use of panel data and dynamic difference-based estimators is an explicit attempt to overcome the uncertainty of the intertemporal direction of effect. The following system of equations describes the model used in the empirical analysis:

$$\Upsilon_{it} = \vartheta\delta_{it} + \varphi_i + \varepsilon_{it}$$

$$\varepsilon it = \gamma_i + \sigma_t + \mu_{it}$$
$$i = 1, \ldots, N \;\&\; t = 1, 2, 3, 4, 5.$$

Where represents the outcome variable for individual i at time t, which differs across the four distinct specifications. The study employs four distinct outcome variables, 1) satisfaction with life, 2) self-reported health, 3) employment status, and 4) future prospects. δ_{it} is a covariate matrix of control variables which are time and individual variant. φ_i captures variables that are time constant but individual variant. Moreover, the error term (ε_{it}) contains three components, one that is only time variant, one that is only individual variant, and one the is both individual and time variant.

The system is fit to the data using dynamic Arellano-Bond (Arellano & Bond, 1991) Generalised Method of Moments and fixed effects estimators. The use of Arellano-Bond estimators solves many of the problems of endogeneity mentioned earlier, specifically the problems associated with unobserved heterogeneity. However, given the dynamic nature of the estimation procedure, the use of Arellano-Bond estimators does require additional assumptions and restrictions (Kiviet, 1995); specifically, it is necessary to apply intertemporal restrictions. First, in order to account for the persistence in subjective opinion, the covariate matrix (δ_{it}) is adjusted to incorporate an AR(1) term with the following form:

$$\delta_{it} = Y_{it\text{-}1} + \theta_{it}$$

Moreover, the addition of this one period dynamic term ensures that the time series of the outcome variables are assumed to follow a Markov process.

$$E[\, Y_{it} \mid Y_{it\text{-}1} \,] = E[\, Y_{it} \mid Y_{it\text{-}s} \,] \;\forall\; s > 1$$

The Markov assumption states that the entire history of the outcome variable is contained within the most recent lagged observation. Therefore, controlling for only a single lag is sufficient to control for all historical unobservable information contained within the time series of the outcome variable. While this specification is vulnerable to scrutiny, it greatly simplifies the estimation procedure. In addition to Arellano-Bond estimators, fixed effects methods are employed. While Arellano-Bond is preferred, the value of adding fixed effects is twofold. First, it serves to test the robustness of the model specification, and second, it can be interpreted without considering the dynamic nature of the variables. That is, Arellano-Bond is specifically suited for use when dynamic interactions and persistence exist between the included variables. Therefore, the addition of fixed effects estimation allows for an alternative perspective when interpreting the results. However, it must be noted that due to the small number of time observations, the fixed effects estimation procedure cannot rely on its asymptotic properties and will likely deliver attenuated coefficient estimates. The following equation (Nickel 1981) demonstrates the nature of this inconsistency, which grows as T gets small.

$$\operatorname*{Plim}_{n\to\infty} \hat{\beta} - \beta = \frac{-(1+\beta)}{T}\,(\varphi)$$

The variable of interest is an index of technological assets owned by the individual. The index is created using a Principle Component Analysis (PCA). PCA is a valuable technique in

that it allows for dramatic reduction in dimensionality while retaining the underlying global correlation structure of the data. In short, it enables the use of fewer variables while keeping the bulk of the important information contained within those variables (Wold, Esbensen & Geladi, 1987). The adequacy of each component is tested using the Kaiser-Meyer-Olkin (KMO) test (Cerny & Kaiser, 1977). Only components with a KMO value greater than 0.8 are used in the empirical analysis. Moreover, for the purpose of between group comparisons, a supervised machine learning algorithm is applied to the technological asset index. The algorithm (k-means clustering) separates the sample into four independent groups based on similarity with regard to the measure and composition of their asset vectors.

Table 1: Individual variable weighting within the Principal Component Analysis

Variable	Comp1	Comp2
TV	0.3793	-0.3496
Satellite	0.3445	0.3657
Computer	0.2805	0.5066
Cell phone	0.2175	-0.356
Electric Stove	0.3701	-0.3609
Microwave	0.4096	0.1652
Fridge	0.4086	-0.2935
Washing Machine	0.3738	0.342

Data

The empirical analysis uses data from all five waves of the National Income Dynamics Survey (NIDS). By design, NIDS is a nationally representative panel dataset which tracks the same individuals across time. The period covered by the survey is 2008-2016, and surveys were completed every two years. The entire sample is used, thus rendering the panel unbalanced. The final models are fitted to a sample size of slightly less than 13 000 individuals. Table 2 summarises the mean value of certain variables of interest across four distinct wealth groups – with each quartile representing a portion of the total population ordered from 1 to 4 by technological asset ownership. Group 1 is the poorest, and group 4 the wealthiest.

Table 2: Comparative T-tests over the means of certain variables of interest

	1	2	3	4
Health	2,14	2,07*	2,05*	2,004*
	(0,005)	(0,004)	(0,004)	(0,006)
Satisfaction	4,52	4,93*	6,35*	5,57*
	(0,15)	(0,01)	(0,014)	(0,017)
Perceived Social Rank	2,11	2,32*	2,67*	3,198*
	(0,005)	(0,005)	(0,005)	(0,007)
Social Rank Prospects	3,767	4,03*	4,35*	4,73*
	(0,009)	(0,008)	(0,007)	(0,009)
Household Size	6,03	6,15*	5,92*	5,16*
	(0,02)	(0,015)	(0,014)	(0,016)
Male	0,44	0,44	0,44	0,45*
	(0,002)	(0,002)	(0,002)	(0,003)
Food Expenditure	986,13	1160,1*	1522,66*	2471,43*
	(3,15)	(3,33)	(5,57)	(13,89)

	1	2	3	4
Education	5,03	5,89*	6,81*	8,34*
	(0.02)	(0,02)	(0,021)	(0,03)

Own calculations using the NIDS data set. Values are averages across the 5 waves. * indicates a significant difference in means at the 5% level. Each column represents a distinct quartile based on the technological asset index. With the asset index score increasing from quartile 1 to 4. Standard errors in brackets.

Table 2 confirms that ownership of technological assets differ significantly between the groups. Self-reported variables such as satisfaction and perceived social rank are higher among groups with more command over technological assets. However, these values must be interpreted with the understanding that individuals with more command over technological assets are generally wealthier, and these findings should then be expected. Essentially, the asset index is a proxy for overall wealth in most cases. Perceived health status displays an interesting result in that it is higher among individuals with fewer assets. A possible explanation for this is that any measure of perceived health is based almost entirely on a comparison with one's peers. In poor communities, in which severe illness does exist (tuberculosis for example), individuals may perceive themselves as being relatively healthy if they are free from any such disease.

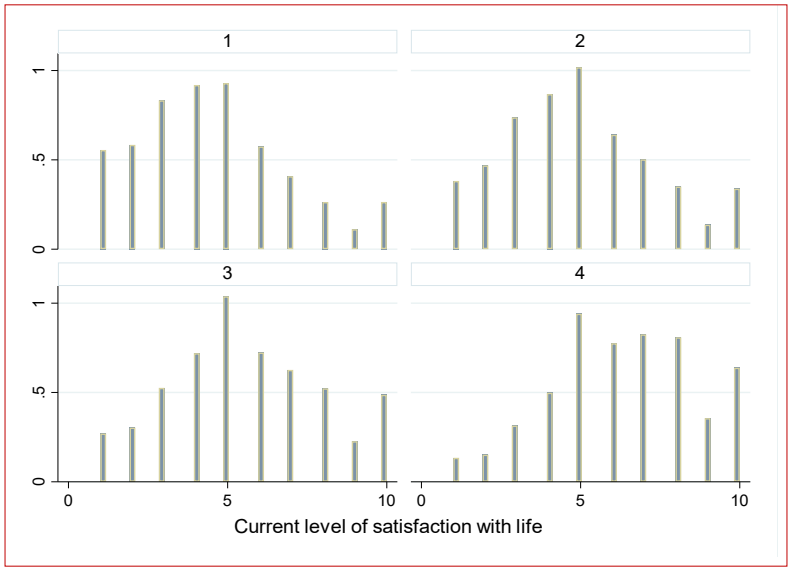

Figure 4: Histogram of satisfaction measure across quartiles

Figure 4 shows that the distribution of the measure of satisfaction varies dramatically between individuals from different quartiles. The group in quartile 1 has a distribution with a relatively long upper tail, indicating that the majority of individuals within this group report low levels of satisfaction with life. This is in stark contrast with quartile 4, a group from which the distribution indicates a large proportion that report being relatively highly satisfied with life. Figure 5 shows the distribution across the quartile groups for a self-reported measure of the individual's perceived social ranking five years from now. This is essentially a measure of how positive individuals are about their future prospects. It is clear that the distribution for the first three quartiles is relatively constant (and normally distributed); while the mean progressively shifts to the right, the margin of this shift is virtually negligible. The distribution for the group in quartile 4 is skewed to the left, with the majority of individuals reporting positive sentiment about their future prospects. This indicates that those with more technological assets are more positive about their future.

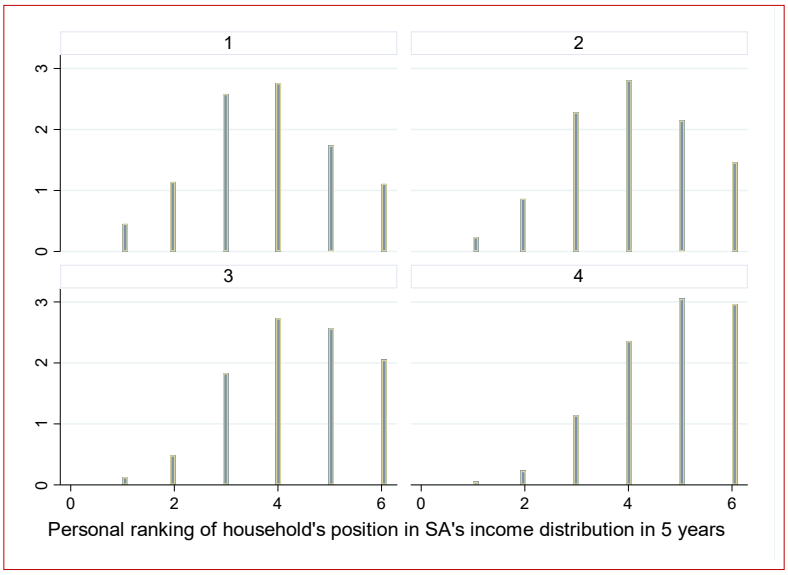

Figure 5: Histogram of future prospects across quartiles

Empirical results

Table 3: Regression results for one-step GMM and fixed effects estimators

	(1)	(2)	(3)	(4)	(5)	(6)
	Satisfaction		Future Prospects		Health Status	
	Arellano-Bond	Fixed Effects	Arellano-Bond	Fixed Effects	Arellano-Bond	Fixed Effects
Lag Outcome	-0.090*		-0.073**		-0.313***	
	(0.051)		(0.031)		(0.074)	
Tech PC1	0.163***	0.078***	0.074**	0.016	-0.012	-0.001
	(0.056)	(0.022)	(0.029)	(0.011)	(0.021)	(0.009)
Tech PC2	0.177	0.004	0.048	-0.004	-0.272***	-0.034***
	(0.207)	(0.025)	(0.101)	(0.012)	(0.086)	(0.010)
Social ranking	0.469***	0.470***	0.642***	0.627***	-0.032*	-0.007
	(0.058)	(0.025)	(0.032)	(0.012)	(0.019)	(0.010)
Health status	0.138**	0.109***	0.035	-0.055***		
	(0.054)	(0.023)	(0.027)	(0.011)		
Hours Worked	0.012**	0.013***	0.004	0.002**	0.001	-0.001
	(0.005)	(0.002)	(0.003)	(0.001)	(0.002)	(0.001)
Crime	-0.075**	-0.042***	-0.010	-0.009	-0.020	-0.026***
	(0.036)	(0.016)	(0.019)	(0.008)	(0.013)	(0.007)
Age	0.059**	0.020***	0.033***	0.015***	-0.034***	-0.017***
	(0.024)	(0.008)	(0.012)	(0.004)	(0.010)	(0.003)
Controls	y	y	y	y	y	y
Observations	5,62	23,83	4,108	21,807	6,336	24,054
Number of pid	3,448	12,917	2,68	12,336	3,879	12,993

The regressions above are estimated using Arellano-Bond and Fixed Effects estimators. Arellano-Bond is performed using Stata's xtabond command. Each regression is estimated using heteroscedastic robust standard errors. The GMM estimates are performed using a one-step procedure. Heteroscedasticity robust standard errors are included in brackets. Control variables used: Household size, marital status, education level, car ownership, medical aid (model 5& 6), and Income.

Model 1 suggests that commodities do increase the self-reported level of satisfaction of individuals over time by a statistically significant margin. This finding is corroborated by the fixed effects estimator. However, the second principle component of the commodity index is insignificant. The composition of the second component is heavily weighted toward higher value assets such as computers, washing machines and satellite dish systems. Therefore, it appears that at the upper end of the asset distribution, the marginal returns to satisfaction are greatly diminished, and insignificant. Perhaps an even more interesting finding from model 1 is that the past values of satisfaction are insignificantly correlated with the current level of satisfaction – past happiness does not determine future happiness. Model 3 shows a similar result to those found in model 1: more commodities are correlated with improved future prospects over time. That is, a positive shift in the command that an individual has over commodities will generally improve their thoughts about their own future prosperity; however, this coefficient is small. Again, the second component is insignificant, a finding that can be interpreted as more commodities among those that already have commodities does not have much effect on perceived future prospects. Keeping with this line of reasoning, it appears that the positive and significant coefficient attached to the first component indicates that an increase in a broad array, rather than an increase in a few specific, commodities is correlated with a more positive future outlook of individuals.

Model 5 shows that perceived health status is insignificantly correlated with the first commodity component, which indicates that a general increase in one's command over assets does not affect perceived health, controlling for other included variables. However, the second component is significantly and positively correlated with perceived health status. This finding could indicate that only the introduction of higher value commodities into one's life significantly affects perceived health – or broadly the ability to gain a better understanding of one's health relative to those around you. An additional interpretation could be that as one gains commodities of value, one's relative perceived ranking compared to those around you improves. Personal health could simply be an outcome of this general feeling of improvement relative to those in the same environment.

However, the models in Table 3 do not fully account for potential household dynamics, environmental factors, nor do the models incorporate any non-linear effects. Therefore, an additional set of regressions are estimated using the Arellano-Bond two step estimation procedure, which better accounts for heteroscedasticity in the errors. This heteroscedasticity is common when controlling for more household and environmental factors. Moreover, these regressions include a number of controls not used in the previous regression models. Non-linear effects are included in the form of interaction terms, each of which interacts the technological asset index with the lagged outcomes variable per model. The regression results for these additional models are displayed in Table 4.

The addition of the interaction term generates some interesting results across all four regressions. First, from model 7 is it evident that the most significant predictor of present employment is past employment, which is intuitively what one would expect. Technology, however, does not predict the ability of an individual to gain employment, as noted by the insignificance of the coefficient. Interestingly, the interaction term between lagged employment status and the technological asset index is significant and positive; it indicates that marginally more technology given that the individual was employed in the previous period improves the chances of being employed in the current period by 7 percent. A possible interpretation of this is that once employment is gained, the command over technology improves the ability of an individual to remain employed. It is possible that the command

over technology enables an individual to better leverage their current employment, build and maintain better employment networks, or simply be a more effective and valuable employee.

Table 4: Regression results for two-step GMM estimators

	(7) Employed	(8) Satisfaction	(9) Future Prospects	(10) Health Status
Lag Outcome variable	0.286***	-0.152*	-0.056	-0.403***
	(0.039)	(0.084)	(0.039)	(0.033)
Tech PC1	0.001	0.803***	-0.172*	0.186***
	(0.009)	(0.235)	(0.100)	(0.062)
PC1 x lag Employed	0.077***			
	(0.027)			
PC1 x lag Satisfaction		-0.129***		
		(0.049)		
PC1 x lag Prospects			0.069***	
			(0.025)	
PC1 x lag Health				-0.046***
				(0.016)
Tech PC2	0.003	0.076	0.017	-0.005
	(0.005)	(0.221)	(0.019)	(0.010)
Decision Maker (Groceries)	0.038***	-0.013	0.066	-0.024
	(0.013)	(0.144)	(0.047)	(0.027)
Decision Maker (Assets)	0.078***	-0.129	0.043	-0.041
	(0.013)	(0.141)	(0.047)	(0.027)
Controls	y	y	y	y
Observations	27,358	4,541	15,285	31,269
Number of unique Individuals	13,967	2,899	9,071	15,600

The above regression models are estimated using Arellano & Bond estimation. The estimation used the two-step GMM procedure, which produces a less naïve weighting matrix that takes the residuals (and thus heteroscedasticity) of the first stage regression into account. Windmeijer corrected standard errors are included in brackets. Controls: Household size, marital status, educational attainment, car ownership, health (not model 4), crime, age, parent's education, identity of the household head, number of elders in the household, electricity connection, wages (only model 2), hours worked (model 2)

Model 8 uses satisfaction as an outcome variable. It indicates that the command over technology is a large positive and significant predictor of self-perceived satisfaction – almost an entire unit on a scale of 1 – 10. Interestingly, the lagged value of satisfaction is negatively correlated with the current value. The term that interacts the lagged value of satisfaction with the technological asset index is negative and significant. This negative coefficient is one without an intuitive explanation. As it is an interaction between two continuous variables, a purely econometric interpretation will be limited. It could be the case that the negative intertemporal correlation of satisfaction is so strong that it negates the positive effect of a greater command over technology. Alternatively, it could be the case that those with an already high command over technological assets have a greater negative intertemporal correlation of satisfaction.

Model 9 shows the results of a regression in which the outcome variable captures positive expectations of the future. It is notable that the coefficient on the technological asset index is negative, but significant at only the 10% level. However, the term that interacts lagged positive expectations and the technological asset index is both positive and significant. This result

indicates that at a given level of the lagged expectations variable, marginally more technology improves the individual's expectations about the future. This finding seems intuitive, and one that is in line with the broader notion that individuals that are actively moving up social strata will gather more technological assets while simultaneously revising their expectations about their future prospects upwards. In this way, both the dynamic and contemporaneous correlation between technological assets and future prospects indicate that increased command over commodities improves one's expectations about future social rankings.

Model 10 shows the results for a regression with self-reported health status as the outcome variable. The results differ dramatically from those found in model 5. First, the first component of the technological asset index is found to be significantly positively correlated with health status while the second component is found to be insignificant. Model 10 does corroborate the findings of model 5 in that the lagged value of health status is negatively correlated with the current value. The interaction term of health status with the technological asset index is significantly negatively correlated with health status. However, the coefficient is extremely small. This finding reflects the absence of a strong interactive effect between the lagged health status of the individual in the previous period and their command over assets.

Conclusion

This analysis investigates the extent to which the ownership of technological assets can increase the economic and social welfare capabilities of South African individuals using the National Income Dynamics Survey dataset. The main research question underlying the empirical analysis is as follows: Does the ownership of technological assets improve subjective measures of well-being? The question is answered using dynamic panel estimation techniques which consider the intertemporal persistence that is likely to exist within the self-reported outcome variables of perceived health status, satisfaction with life, expectations about future economic ranking within society, and the objective measure of employment status.

The study makes use of Sen's (1985) capabilities approach, and posits that increased command over technological assets will increase the capabilities of an individual. That is, more access to technology will increase the ability with which individuals can perform tasks with the explicit intention of increasing their welfare. The empirical results indicate that this process is found in the data: increased command over technological assets does improve a number of self-reported measures of well-being and economic activity. More specifically, an increase in the command over technological commodities is positively correlated with employment, life satisfaction, health status, and expectations about future economic ranking within society.

These findings do seem intuitive, and would generally be in line with Sen's original writings. While the effect of technology on human life is generally positive, the complete psychological effects are not yet fully understood. The most productive outcome of this study is that there is value to be found in the use of self-reported measures, and that more work should be done to fully understand how exactly technological assets are affecting individuals in the developing world. One area where future research can improve would be from the use of a deeper analysis which accounts for different types of technology rather than relying on a single asset-based index.

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The adoption of digital technology for South Africa's 2021 municipal elections, and prospects for the future

Limukani Mathe
School of Communication, University of Johannesburg
limukanim@uj.ac.za

Abstract

This article / study reflects on the digital technologies and online processes adopted for conducting South Africa's 2021 municipal elections, and the degree to which this encourages the future use of additional digital technologies. It utilises theoretical perceptions of politics and technology to analyse the perspectives of politicians, IEC officials and voters. It discusses the Independent Electoral Commission's (IEC) use of voter management devices (VMDs) and online voter facilities, which resolved the perennial challenge of double voting. It shows that, due to COVID-19, voter apathy and possibly manual voting, the voter turnout was low. It argues that technological progress made during the 2021 municipal elections should be used to suppress fears over the consequences of electronic voting. Limited access to the internet and electricity blackouts continue to limit the use of digital technology and online process in managing South African elections. However, the IEC could adopt parallel e-voting and manual voting processes, as it did successfully for voter registration during the 2021 municipal elections.

Keywords: municipal elections, digital technologies, web 2.0, voter management devices (VMDs), e-voting, positive will

Introduction

This article analyses the opportunities and challenges presented by the digital technologies and online processes adopted for conducting South Africa's 2021 municipal elections. Digital technologies and online platforms have eased the participation of citizens in electoral processes (Lee 2003; Xenakis and Macintosh 2008). Among others, they have been used for conducting censuses, voter registration, counting votes, and facilitating other huge tasks that can take days to complete if done manually (Xenakis and Macintosh 2008). It is clear that digital technologies, including cell phones, the internet, and various computer-based systems, can significantly enhance democracy. Thus Debra et al (2017: 1) point out that 'the application of information technology (IT) in a democracy can promote efficient organisation, processing, communication, storage and retrieval of information needed by election management bodies'.

Due to the Covid-19 pandemic, South Africa adopted online voter registration and other digital electoral processes for the municipal elections conducted in November 2021. Voter management devices (VMDs) were used to register voters and build the voter's roll. This article analyses the challenges and opportunities presented by the digital processes used by the Independent Electoral Commission (IEC) for South Africa's 2021 municipal elections. Based

on these experiences, it further examines the potential for electronic voting, or e-voting, which the IEC wants to pilot. The adoption of innovative electoral systems and methods (including e-voting) is a topical issue, worthy of close analysis. Thus this article also discusses socio-political factors that may hinder the adoption of new technologies for managing elections in South Africa, as well as its potential for bolstering sustainable democracy.

South Africa's 2021 municipal elections

The 2021 municipal election differed from previous elections due to challenges posed by the COVID-19 pandemic. Among others, the elections were meant to take place in October, but were postponed to November. The IEC had to innovate to ensure the elections could be successfully conducted. New measures included online voter registration, candidate nominations, and special vote applications. The IEC also introduced voter management devices (VMDs) which were used to monitor live voting and avoid double voting. The municipal elections involved 4 468 ward elections, 205 proportional representation (PR) elections in local councils, 8 PR elections in metro councils, and 44 district council elections across the country (IEC 2021). At the local government level, South Africa uses a mixed electoral system in terms of which half the councillors are elected at the ward level, and the other half via a closed-party proportional representation (PR) list system (Mathe 2021).

For the 2021 municipal elections, the IEC aimed at testing innovative tools such as the VMDs and online processes. It also wanted to test e-voting, but this proposal was rejected by the parliamentary portfolio committee for home affairs, citing fears such as hacking and insufficient budgets. The portfolio committee stated that all stakeholders should be involved in the decision-making because voting methods were a policy matter that could not be decided by the IEC alone.

However, the ongoing discussions of e-voting at the parliamentary level indicates that digital voting is foreseeable. After rejecting the e-voting proposal, the portfolio committee stated:

'The truth of the matter is that technology is upon us and preparation must be started to ensure that we have both the legal framework and the technical experience that will ensure that elections are secure if a decision to vote through e-voting is taken' (Parliament Communication Services 2020).

This means that Parliament acknowledges the need to embrace new technology, but has reservations over about the legal framework for implementation. However, Parliament decided that e-voting should only be piloted, rather than being fully rolled out in the 2021 municipal elections (IEC 2020) This points to the fact that social dynamics may promote or derail innovation. The relevant factors in South Africa include distrust among politicians, and fears of electoral fraud, hacking, and the rigging of election results (Mathe 2021). South Africa has enormous digital inequalities due to huge inequality and class differences, as well as the disparities between urban and rural areas. In January 2020, internet penetration in South Africa through mobile phones and computers was estimated at about 62% (Fokane 2021).

The portfolio committee recommended that the IEC should further clarify its frameworks and procedures, especially in respect of piloting e-voting. It stated that a pilot was needed to ensure that fears around the security of e-voting were allayed (Parliament Communication Services 2020). It also asked the IEC to provide case studies of countries where e-voting was successfully implemented. There were speculations in the media that the IEC would launch

an e-voting pilot in July 2020. However, in September 2020, the IEC acknowledged that the planned pilot had been hampered by budget constraints (Fokane 2021).

Thus the 2021 municipal elections were conducted without any innovations besides online voter registration and nominations, and the use of VMDs. This article examines the challenges and opportunities presented by the adoption of these measures. It further examines the feasibility of e-voting in the light of the experiences during the 2021 elections.

Digital technologies in electoral processes

South Africa is not the first country to embrace technology and innovation for electoral processes. There is a large literature on the adoption of digital technologies for managing elections in various countries as a means of addressing various challenges, including double voting and low voter turnout. It is noteworthy that voter turnout in South Africa has been declining, due to voter apathy (see Mathe 2021; Schulz-Herzenberg 2019: 463). Schulz-Herzenberg (2019: 463) notes that the previous municipal elections in South Africa were marked by 'higher abstentions, individual-level vote shifts, vote splitting, and later-than-usual vote decisions as evidence of a decline in partisan loyalties'. Apart from the growing lack of trust in the political system, low voter turnout has been attributed to poor preparation by the IEC, lack of voter education, long queues at the voting stations, challenges surrounding the voter's rolls, and, more recently, bad weather and COVID-19 (see HSRC 2021; Mathe 2021; EISA 2019).

From 2019 onwards, the IEC has been working on ward delimitation and increasing voting stations in order to reduce long queues, hoping that this would increase voter turnout (Mathe 2021). This article argues that low voter turnout should be attributed to several factors, including manual voting itself. The traditional ballot box in South Africa has also been flawed by allegations of double voting, slow vote counting, delays in the distribution of election material, and expensive ballot papers (EISA 2019). The case of ballot stuffing at Dihlabeng Maluti Hoogland School voting station during the 2016 municipal elections where party agents had to intervene over unsealed boxes of election material is one example of manual voting challenges in South Africa (EISA 2019). Traditional ballot box voting starts with voter registration (compiling and correcting a voter's roll). On election day, it proceeds with voter verification at the polling or voting station, the ticking of the voter's details, marking a fingernail with indelible ink, issuing the ballot papers, marking the ballot papers in a cubicle; and casting the ballot paper into a sealed ballot box (Alam et al 2020; Power et al 2021). While many countries still use the traditional ballot box voting method, it has been criticised as slow and insecure. Moreover, according to EISA (2009), the costs of printing ballot papers in South Africa have generally been very high.

While some countries have hesitated to adopt new methods such as e-voting, largely due to hacking fears, literature shows that the ballot box voting system is also prone to vote rigging, especially in Africa (Alam et al 2020). Mozaffar & Schedler (2002: 5-6) argue that this system is prone to technical and administrative errors resulting in defective ballots, incomplete and inaccurate voters' rolls, the exclusion of registered voters, inaccuracies in counting and tabulating of votes', resulting in disputed elections. Although disputed ballot box elections are not unique to Africa, literature shows that most deficient manual elections have occurred in developing democracies in Africa (Schaffer 2002: 69). Allegations of and disputes over irregularities have occurred in Zimbabwe, Republic of Congo, South Africa, Mozambique, Malawi, and many other African countries (Mozaffar & Schedler 2002; Debra et al 2017;

Mathe 2020). However, election rigging is a common problem in every democracy in the world -- hence the need to devise a more efficient and more accurate voting method. Recent studies suggest that the solution lies in electronic voting (Mozaffar & Schedler 2002; Achieng & Ruhode 2013; Debra et al. 2017; Alam et al. 2020, Mathe 2021). However, this does not mean that electronic voting does not have potential problems of its own.

Some studies argue that e-voting has the capacity to increase voter turnout, especially among the growing digital generation (Achieng & Ruhode 2013). Some countries in Europe, Brazil and India have piloted and implemented e-voting. In 2005, Estonia piloted internet voting (i-voting) in its national elections. Voters logged in on the online voting system with their identity cards, but their anonymity was maintained. In 2017, Estonia stated that internet voting had saved the country 11 000 working days (Power et al 2021). In the early 2000s, the United States also piloted internet voting for military personal abroad. Today, various forms of e-voting are in use in state elections. Among others, voters receive e-ballots electronically, vote manually, and post them to local election centres. Power et al (2021) argue that 'the experience of the USA is a reminder that e-voting is a broad concept which does not always refer to casting a ballot electronically'.

In 1996, Brazil also implemented e-voting for more than 200 million people. With simplicity as its primary objective, the voting machine accomplishes three steps -- voter identification, secure voting and tallying -- in a single process, eliminating fraud based on forged or falsified public documents. However, for security reasons, the voting machines were not connected to the internet. In 2005, Germany implemented e-voting for two million people who cast their votes electronically, although the Constitutional Court later ruled that the e-voting machines were unconstitutional (Power et al 2021). In 2014, Namibia adopted electronic voting machines from India, which were prone to technical glitches such as slow responses to verify voter's details (Alam et al 2020). According to the Electoral Commission of Namibia (ECN), some voters turned away due to the slow voter verification process (ECN 2014). Diamond (2010) argues that, while not exempted from possible challenges such as hacking, e-voting promotes democratic participation.

Other technological opportunities adopted by some African countries include biometric technology that halts double voting. Ghana used the biometric system in 2012 for voter registration and verification. Debra et al (2017) notes that the biometric system promoted high voter turnout and confidence in the electoral process. The biometric system acted as a 'forensic measure against election fraud such as impersonation and multiple voting' because it captured the voter's fingerprints and other personal features (Debra et al 2017: 1). Biometric technology identifies and verifies voters' physiological features such as human traits, identity, fingerprints, ear shape, face, hand vein, retina and voice (Wayman 2000; Rhodes 2003; Jain et al 2004). However, in Ghana, numerous problems were experienced with the biometric system, such as the slow verification of voters, human error, and other irregularities due to manipulation by polling agents (Debra et al 2017). In 2015, Nigeria used biometric card readers for 'direct data capturing for the revalidation of the voters' register, accreditation of eligible voters and permanent voters', making it impossible for a voter to vote more than once (Nwagwu 2016: 305). Biometric card readers were able to discourage double voting, though they were affected by technical faults (Alam et al 2020).

Zimbabwe used a biometric system for its 2018 general elections. Though the voter registration was biometric, voter verification on election day was manual, resulting in a disputed election (Mathe 2020). This shows that digital technologies alone cannot guarantee a free and fair election (Mathe 2020).

However, these sorts of challenges do not limit the advancement of technology. There are many technological options that can be used for elections. Blockchain technology has gained prominence as the most secure system for electoral processes. Blockchain is the 'collective digital memory of a group of people', functioning as a public ledger (Racsko 2019: 1). Blockchain technology is also viewed as 'a distributed database that maintains an ever growing list of data records secure from tampering or revision' (Curran 2018: 1). Racsko (2019: 1) views the blockchain as a 'secure digital log of a set of transactions', while Madavi (2019) notes that data entered into the blockchain network cannot be deleted. A blockchain network can be controlled or monitored by three or more servers, making it difficult for one server to erase data without the acknowledgement of the whole network. Over the past eight years, blockchain technology has been piloted and established in cryptocurrency, providing 'indestructible, high-end cryptography security that is transparent and publicly verifiable' (Alam et al 2020: 2). The system is now used for cash transactions, public services, utilitarian agreements and security services, among others. For elections, the blockchain guarantees voter anonymity while making all votes public as an immutable ledger (Racsko 2019; Alam 2020).

In 2018, a blockchain electoral system was piloted in South Korea and West Virginia in the United States. South Korea implemented blockchain technology for a private sector, and West Virginia used it for a diaspora vote as (Zdnet 2018; CBinsights 2019; Racsko 2019). While expensive to establish, analysts believe the blockchain can resolve all the problems and challenges association with electoral systems. They believe the blockchain is able to promote trust because of its potential to block electoral rigging, which can be spotted easily within the network (Alam et al 2020).

Against this background, this article investigates the digital systems and methods used for the 2021 municipal elections and their ability to foreshadow the introduction of e-voting.

A theoretical perspective

The role and impact of digital voting technologies in a democracy are debatable. Some scholars believe they can enhance democracy, while other argue that the efficacy of technologies are determined by social factors (see Ellul 1990; Ott and Rosser 2000; Castells 2004; Mutsvairo and Karam 2018; Mathe 2020). Technological determinism posits a relationship between politics and technology, while the social construction of technology perspective holds that information technologies alone cannot solve political problems (Ellul 1990).

Langdon Winner (1986) argues that some technological privileges or access are linked to institutionalised patterns of power or authority. Thus, utilised effectively technologies can be tools of democracy or suppression. For the purposes of democracy, information and communication technologies (ICTs) can democratise societies through the provision of quality information (Ott and Rosser 2000; Hill and Hughes 1999). Political communication studies support the notion that digital technologies can promote democracy through social media and other spaces (Lee 2009; Mathe and Caldwell 2017). The internet, (Web 2.0 and Web 3.0) and digital devices or media have enhanced political participation by political players and voters, and have enriched voting choices (Ott and Rosser 2000). Kedzie (1997) argues that information technologies can influence change by awakening and promoting citizen engagement among marginalised people. However, the main challenge is digital inequality, whereby disadvantaged people may have less access to some technologies and information.

Although digital technologies provide democratic opportunities, human or social factors may manipulate or discourage technological applications. Theorists about the social construction of technology believe that socio-political problems do hinder the effective use of technology for promoting sustainable democracy. For example, digital technologies in an election may be susceptible to manipulation such as hacking. Robert Dahl (1989: 339) argues that 'the evolving technology is bound to be used somehow, for good or ill, and can be used to damage democratic values and the democratic process or promote them'. While Castells (2004) notes that technology alone cannot guarantee the change of political systems and democratic processes, Putnam (2000) claims that technology can erode social capital. Thus, the social construction of technology perspective criticises an overreliance on technology for political solutions. This means the human factor or social actions play a fundamental role in determining the effective use of technology (Joerges 1999; Hoff 2000). Castells (2001: 5) asserts that the internet is a 'malleable technology that is susceptible to modification by its social practice, thereby leading to a whole range of potential social outcomes'. Therefore, social theorists highlight that positive political will is significant in determining the success of technology for democratic purposes. Given the tenets of the social construction of technology and the technological determinism paradigm, this article analyses the opportunities and challenges presented by the use of digital electoral processes in South Africa.

Methodology

A digital ethnographic approach was implemented on social media, specifically on YouTube, to analyse the IEC's updates on the municipal elections. This comprised qualitative textual analyses of YouTube videos namely the speeches of the IEC Chief Executive Officer, Sy Mamabolo; the IEC Chairperson, Glen Mashinini; and the IEC Commissioner, Nomsa Masuku. The videos studied were 'The IEC launches 2021 municipal elections' (9 July 2021), 'Update on the progress of election day' (1 November 2021), and 'IEC announces 2021 municipal election results' (4 November 2021). This method provided suitable data for this study. Through textual analysis, speakers can easily be studied without them being aware of this. The information provided was used to analyse how digital technologies were employed for the 2021 municipal elections.

The textual analysis of the IEC reports on the municipal elections was supplemented by in-depth interviews with politicians from several political parties on the use of digital technologies and the prospects for e-voting in South Africa. These interviews were conducted between 1 August 2021 and 10 February 2022. Most of the interviews were conducted telephonically, while some respondents preferred responding via emails. A total of ten politicians participated in this study; while some represented their parties, others would not disclose their party affiliations. The interviews were aimed at extracting perspectives on the use of digital technologies, and the possibility of electronic voting (see Appendix). Interviewing representatives of various political parties provided a balanced perspective.

Lastly, two focus group discussions were conducted with voters to gain their perspectives on online registration for the 2021 municipal elections. This was done by means of WhatsApp group calls. One group comprised six respondents, and the other 12. Most were from urban areas in Gauteng and KwaZulu-Natal, while a few were from peri-urban areas in the Eastern Cape. There were more males than females, and their ages varied from 27 to 40. Although the respondents were not drawn from all the provinces, they did represent a spread of South African citizens in urban or peri-urban areas. While the discussions were open-ended, the

basic questions appear in appendix 1. The data was arranged into themes, suited to the objectives of the study.

Findings

Online registration and voter mobilisation

As noted earlier, the IEC introduced an online voter registration facility, aimed at bolstering voter registration despite the COVID-19 pandemic. A total of 26,1 million voters were registered; however only 12,3 million voted. It is argued that voter turnout would have been better if the online registration had been backed up with electronic voting. Because this was still manual, voting was affected by fears of contracting COVID-19.

Voter apathy is a significant factor which should always receive attention (Schulz-Herzenberg 2019). Young people are under-represent on South African voter's rolls, and the IEC specifically wanted to attract more young voters via digital voter registration. Thus Mamabolo stated:

> 'Young voters have had fewer opportunities to register than older voters, with a significant number of them only qualifying for registration over the past few years. Secondly, the youths of today are used to operating within a digital and online ecosystem, and frequently seek a more convenient and accessible option for registration.'

Online voter registration and voting is clearly more convenient, and will almost certainly attract more young people. One respondent noted that the online voter registration was based on a good verification system, which required the user's cell phone number and one-time password (OTP). However, the online registration and other online processes experienced certain challenges, largely due to limited internet coverage and expensive data. One respondent remarked that digital online processes were costly due to expensive data, especially for rural dwellers. The voter went on to say that government should subsidise data to allow youths to participate.

Respondents stated that, due to expensive data and a lack of personal digital devices, relatively few voters utilised the online voter registration system, with many registering manually on registration weekend instead. Some noted that the online voter registration interface was user-friendly, although some glitches were experiences with the submissions of national identity (ID) numbers. Given that not all voters registered online, respondents argued that online and manual registration should always be combined.

Another challenge arose with online candidate nomination. The IEC reopened online voter registration and candidate nominations in September, and scheduled the voter registration weekend for 18 and 19 September (instead of 17 and 18 July). Re-opening the candidate nominations provoked criticism from opposition parties which argued that this was aimed at providing a lifeline to the African National Congress (ANC), as it had previously failed to register candidates in 93 wards. The Economic Freedom Fighters (EFF) also claimed that the IEC had delayed closing the online candidate nominations. These complaints reflect the socio-political challenges that may rise from the use of new technologies, and validate Hoff's argument (2000) that the impact of social action on the use of technology cannot be ignored.

A digital voter's roll

It is common knowledge that without an accurate voters' roll, elections cannot be free and fair, and cannot ensure the participation of every citizen. Mathe (2020) describes the electoral challenges faced in Zimbabwe due to an inaccurate voter's roll, including allegations of ghost voters and double voting. In South Africa, the IEC reported that it had spent five years since March 2016 engaging in a comprehensive programme to update the voters' roll. On 9 July, 2021, the IEC reported:

> In March 2016, we had complete addresses for just over 8,5 million or 33% of registered voters. Today this figure stand at 24,2 million, or 92%. Of course, we do want to improve that 92%, but in a country with human settlement patterns such as South Africa, 100% will not be possible.

Online voter registration provided voters with an opportunity to update their addresses. Evidence from IEC shows that by 9 July 2021, there were still more than 1,2 million registered voters without addresses on the voters' roll. It is argued that the online facility for registering changes of address should be permanently available, thereby giving voters ample time to change their addresses. One respondent noted:

> The IEC has complained (several times over the years, with each budget cut) about budgetary restrictions. In 2021, they only had one registration weekend against two in the past. They also cancelled the piloting of e-voting owing to a lack of funding.

Another respondent noted that the IEC always faced preparation and budget challenges, which affected the smooth running of elections. It is argued there that preparing for a credible election needs ample time, specifically for compiling an accurate voters' roll.

On voting day, some voters could not locate their polling stations, despite an online facility meant to help them do so. This was effectively acknowledged that, early on 1 November 2021, an IEC commissioner, Nomsa Masuku, announced in television that that voters could check their voting station details by dialling *120*42* or sending an SMS with their ID numbers to a specific number.

Despite these challenges, it is argued that the IEC managed to successfully introduce online registration and voter management devices (VMDs) in a short space of time. The digital voters' roll enabled the use of VMDs, which utilised wireless networks, as well as GPS technology. Among other things, the CMDs allowed officials to check instantly whether a voter appeared on the national population register, thereby confirming their citizenship. On 4 November, the IEC stated:

> The voter management device provided access to a real-time voter's roll which enabled election officials to dictate if any voter had already presented himself or herself at the voting station to vote.

This contrasted with the situation in Zimbabwe, where the Zimbabwe Electoral Commission (ZEC) was accused of a failure to monitor real-time voting and detect double voting through the biometric system (Mathe 2020).

Blocking double voting via the CMDs

On 4 November 2021, while announcing the election results, the IEC stated that the municipal election was as much about participation as about the introduction of digital solutions. The VMDs were the most technologically advanced election devices ever used in South Africa. A total of 30 387 VMDs were deployed, connected to a central database via an access point network. The IEC reported that they enabled and strengthened controls over the voting process. Mamabolo declared:

> 'Once ballots were issued to the voter, they could not present themselves at another station without detection. The use of the VMD enabled a live and centrally connected voters' roll, decisively putting to rest allegations of double voting.'

The introduction of VMDs by the IEC was indeed technologically significant. It shows that technology can be useful if applied effectively. The focus group discussions confirmed that the issue of double voting was a perennial problem, which the VMDs had partially resolved. A participant commented that South Africa needed technology that eliminated double voting or vote rigging. This study shows that adoption VMD created prospects for additional devices and systems that will enable the real-time monitoring of quantities of ballot papers issued and on hand at each voting station.

The IEC remains hopeful that the piloted VMDs will also resolve the problem voting stations running out of ballot papers, through the real-time monitoring of quantities of ballot papers per polling station. The VMDs replaced Zip-Zip scanners used over the previous 15 years. The literature highlights that Zip-Zip machines have a history of glitches, causing slow-moving queues, prompting manual voter verification through a hard copy voter's roll and allowing fraudulent double voting (EISA 2019; Mathe 2021). The replacement of Zip-Zip scanners with VMDs were a marked technological advancement. The IEC stated:

> The challenges of the moment as we experience should not cloud the desire to explore digital technology to better our electoral engagement. We dare not retard the progress we have made. … Voter management devices allowed instant electronic capture of the voter's registration details including addresses and where wireless network coverage helped to check that the voter is registered in the correct ward using GPS technology. … Despite challenges, we achieved our innovative objectives of taking our electoral system to the next level of automation through the introduction of the VDM device.

Thus the IEC demonstrated a positive intent to pilot voter management devices. I conclude that, despite significant challenges, South Africa has an electoral management body that is determined to pilot and implement technology for easing electoral processes, possibly leading to e-voting. Mamabolo added that 'innovations form part of electoral commissions, broader utilisation of new technology to enhance all aspects of the electoral process'.

Despite the challenges of bad weather, power interruptions, logistics and other glitches, the IEC used 7 400 VMDs to train electoral officials during the voter registration weekend and other registration initiatives. The advantage was that VMDs could be run offline and would update data as soon as they were back online, thereby resolving internet coverage challenges.

Voting and the tabulation of results

Although the voting process was successfully managed, each and every election has its own logical and technical challenges. The actual voting process from 1 to 4 November 2021 (including special voting on 30 and 31 October) faced several challenges. One problem reported to the IEC was that some voters could not find their names on their voters' roll. Voters could dial *120*42* or 32810 to locate their voting stations. Some voting stations experienced shortages of ballot papers, especially Universal Ballot Templates (UBTs). Twenty voting stations in KwaZulu-Natal and 19 voting stations in the Eastern Cape opened late due to protests. Electricity cuts prompted the IEC to ask Eskom for blackout exemptions to enable vote counting.

Although the VMDS were not reported as hacked, the manual ballot voting was susceptible to stuffing by dishonest polling officials. In one incident, an electoral officer was found stuffing ballots into a box. According to the IEC, party agents and members of the Party Liaison Committee (PLC) exposed the stuffing of ballot boxes as well as the mishandling of ballot boxes. One politician responded that: 'The IEC needs to tighten up the role of its staff in manipulating election process which can create certain level of anxiety to voters and instability across the country.' This shows that human malpractice cannot be ignored regardless of how effective technologies may be. Ballot stuffing by agents is similar to the 2016 Dihlabeng Maluti Hoogland School voting station incident where election material was found unsealed (Mathe 2021). The IEC received 290 objections during the 2021 municipal elections.

A focus group discussant complained that the results have been manipulated over the years through the uploading of result slips from Municipal Offices to the online results system. Other voters noted that the tabulation of results system reflected countless errors over the years. Others added that the tabulation of results, whether manual or electronic, remained susceptible to human manipulation in favour of the ruling party, and only the sophistication of manipulation varied over time. Bantu Holomisa of the United Democratic Party (UDM) added that a country like South Africa could not rely on technology alone to prevent corruption, and was doubtful whether technology should ever be used for voting and tabulation.

Most politicians feared the implementation of technology in electoral processes. Representatives of opposition parties in particular expressed a lack of trust in technology, especially e-voting. Adrian Roos of the Democratic Alliance (DA) noted that the 'twin challenge with digital technology electoral process is a lack of pervasive internet connectivity across South Africa as well as basic technology literacy among a vast majority of the population', as experienced in the municipal elections. He added:

> 'Home Affairs is not even capable of keeping less than 100 mobile units out there in rural communities operational due to connectivity issues. Even fixed, Home Affairs Offices are offline at a chronic level and elections themselves faced a battle to get electricity working in all voting stations on voting day. … The complication is, how do you ensure that persons vote in secret? How do you ensure that it is indeed the voter that votes using whatever credentials? How do you use technologies such as blockchain to ensure that votes are not tampered with?'

Adrian Roos stated argued that the fact that voting and tabulation processes were still manual, helped to circumvent the challenges of failing internet coverage and electricity blackouts.

However, despite a lack of trust in electronic electoral processes, participants agreed that online electoral processes would create opportunities to either enhance voter turnout among youths, or speed up voting and the counting of results. Voter turnout would probably have been better if the actual voting was electronic as well. One participant noted that he could not vote because he felt discouraged about searching for a polling station. This may be an added reason for the poor voter turnout, showing that online voting booths would have been a significant development. It is argued that there is a need to balance technology and political dynamics by combining positive social actions such as transparency, responsiveness, accountability and positive intent with appropriate technological solutions. Technology itself is no substitute for those qualities – it can merely help technically to manage huge tasks.

Conclusion

This article argues that the digital progress achieved in the 2021 municipal elections demonstrates that electronic voting is possible as long as there is positive will. The research findings show that the VMDs blocked double voting, creating prospects of building additional engines to monitor large quantities of ballot papers in real time for each voting station. As usual, the major challenges during the 2021 municipal elections developed around manual vote-counting. This article argues that if VMDs can curb double voting in real time, digital tabulation can also be used for electronic voting. Therefore, there is a need to pilot e-voting, which may boost voter turnout in the digital age. Voters and politicians voiced fears about a dependence on technology. However, while technology cannot serve as a panacea for socio-political ills, it can be a relevant and valuable tool for managing electoral processes. The 2021 municipal elections demonstrated that piloting new technology elections requires positive will. The IEC piloted VMDs successfully, hence piloting e-voting should also be possible. As experiences in other countries show, blockchain is one way of securing electronic voting (Racsko 2019).

This does not mean that socio-political factors determine the effective implementation of technology. The rejection of e-voting by the Parliamentary Portfolio Committee on Home Affairs shows that the political dimension to the design and management of electoral systems cannot be ignored. Politicians displayed a lack of trust in advanced voting technology, highlighting contextual challenges like poor internet coverage and electricity failures. However, in order to boost voter turnout, the IEC could run e-voting and manual voting simultaneously, meaning that those without access to the internet could vote manually, while others could vote electronically. In the 2021 municipal elections, the IEC successfully introduced a dual voter registration process, with some voters successfully registering online, and others registering manually. The IEC cold adopt this dual approach for actual voting as well, thereby significantly raising voter participation, and attract more young voters in particular.

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Appendix: Semi-structured Interview Questions with politicians and Voters

1. What were the challenges faced so far municipal elections in South Africa and how was technology integrated? Probe: How can we incorporate technology for the electoral system?
2. Do you think IEC was prepared for 2021 Municipal Elections?
3. Did you register online or manually, and what were the challenges?
4. What were the other challenges faced during the 2021 Municipality elections?
5. In what way do you think e-voting can enhance voter participation?
6. Can voter turnout increase through e-voting and what are the complications?
7. Do you think the youth will vote if e-voting is introduced?

‘New-new’ diplomacy

A new technological dawn

Robyn Ehryn Williams
SaRCHI Chair: African Diplomacy and Foreign Policy,
University of Johannesburg
robynw@uj.ac.za

Abstract

DIPLOMACY is often characterised in terms of two phases: ‘old’ and ‘new’. Old diplomacy dates from the era of Greek city-states until 1814, when the Congress of Vienna prompted a new phase in diplomacy. Both phases were influenced by trends in international relations, the needs of the state, and the tools that were available at the time. Old diplomacy was secretive, with a small pool of actors. New diplomacy was more open, with the introduction of multilateralism as well as non-state actors. Today, however, a wider array of actors and instruments is at play in international relations. This article argues that a third phase in diplomacy is unfolding, referred to as the ‘new-new’ diplomacy. This has been prompted by the fourth industrial revolution, as artificial intelligence, big data, and the Internet of Things have come to play a significant role This article explores the nature of and trends in the ‘new-new’ diplomacy. It is qualitative, comprising desktop research. It explores primary and secondary literature and refers to several real-world examples that have become apparent over the past five years. The main finding is that contemporary global trends and the influence of advanced technology will not change the relevance of diplomacy and diplomatic agents, but will rather complement it. Diplomacy will remain resilient and agile.

Keywords: diplomacy, fourth industrial revolution, 4IR diplomacy.

Introduction

Diplomacy has long been a feature of human history, but has remained consistently agile. From Greek city states merely seeking to interact with one another to the Congress of Vienna, which eventually led to the establishment of the United Nations, and from formal envoys to Twitter diplomacy, diplomacy has evolved continuously, in line with globalisation and the emergence of international society. This article argues that a new phase in diplomacy – ‘new-new’ diplomacy -- is currently emerging. It is strongly influenced by technology, and involves more non-state actors than before. Diplomacy is based on several well-established pillars, namely communication, interdependence, legal frameworks, and diplomatic actors. As the intersection of the fourth industrial revolution and diplomacy remains relatively new, it is important to understand in which ways diplomacy is impacted by advanced and emerging technologies. This is not the first time that technology intersects with diplomacy – for example, the advent of the radio and the rise of social media allowed state diplomacy to reach far wider audiences (Rawnsley 2016). However, the 4IR is a more disruptive force, as its technologies penetrate every corner of society, making its adoption an imperative. Previously, a handful of technologies were used to enhance diplomatic tasks and practices. However, the

rise of the 4IR has introduced an entirely new era of diplomacy in which technology is a significant driving force.

The article will begin by unpacking the concept of the fourth industrial revolution and its relevance to diplomacy, highlighting key technologies that may impact on diplomatic practice. It provides a historical overview of old and new diplomacy, with the trends and primary characteristics made visible. Next, it discusses 'new-new' diplomacy with a view to reaching a deeper understanding of how new and advanced technologies prompted by the 4IR are changing diplomacy. The study is purely qualitative, based on desktop research of primary and secondary literature in the form of journal articles, books, country reports and conference proceedings. Each pillar of diplomacy is individually analysed to allow a deeper understanding of how 4IR impacts on diplomatic practice.

The fourth industrial revolution

4IR continues to sweep the world, and penetrate various aspects of public and private life. Its disruption is unavoidable. Often referred to as Industry 4.0, 4IR may be understood as 'the digital revolution that has been occurring since the middle of the last century, characterised by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres' (WEF 2019). Primary technologies that dominate 4IR include artificial intelligence (AI), the Internet of Things, Big Data, Robotics and Information, and Information and Communications Technology (ICT). AI is one of the most transformational and impactful technologies. It is multidimensional, and may be applied in various ways. Furthermore, there is 'weak AI' and 'strong AI'- the difference between the two rests in the extensive abilities of the respective versions. Strong AI can act and think like a human, and could therefore construct a response to a particular scenario, while weak AI can only perform its intended reaction (Wisskerchen, Biacabe and Bormann et al 2017: 8).

Old and new diplomacy

There is no official date or event that marks the beginning of old diplomacy; however, the era of ancient Greek city-states is often regarded as its starting point. During this time, city-states mostly had low levels of interaction, and this was the primary purpose of diplomatic relations (Eilers 2006). Diplomacy was closed off and secretive, consisting of physical missions (Otte 2007). While it developed in some ways from the Greek period until the late 1800s, a common theme throughout was that relations were strictly bilateral, referred to as alliances and practiced only by diplomats (Géraud and Pertinax 1945).

New diplomacy erupted onto the scene of international relations at the Congress of Vienna. Held in1814–1815, it was an international diplomatic conference to reconstitute the European political order after the downfall of the French Emperor Napoleon I. Essentially, it was a meeting of ambassadors of European states chaired by the Austrian statesman Klemens von Metternich, and held in Vienna from September 1814 to June 1815.

Another milestone was the formation of the League of Nations, the first worldwide intergovernmental organisation whose principal mission was to maintain world peace. It was founded on 10 January 1920 by the Paris Peace Conference that ended the First World War. It was initiated by United States President Woodrow Wilson, who emphasised the rise and significance of international collaboration among states (Morgenthau 1946). This marked a

new era of multilateralism, in which diplomacy became increasingly open, and later welcomed the inclusion of non-state actors such as non-government organisations and interest groups (Géraud and Pertinax 1945). The establishment of the United Nations in 1946, after World War Two, was a pivotal moment for new diplomacy, as it institutionalised engagement at a multilateral level, even when states did not engage bilaterally (Black 2010).

From the 1960s onwards, Africa's period of decolonisation propelled more states into global politics. The year 1961 saw the adoption of the Vienna Convention on Diplomatic Relations, which set out an agreed framework for diplomatic relations among independent states. An initiative of the UN, it remains a cornerstone of modern international relations and international law and is almost universally ratified and observed. Despite the rapidly evolving nature of diplomatic practice, it has not been superseded.

Later, digital diplomacy became more prevalent. The concept is highly relevant to this article, as it is vital to acknowledge that the intersection of technology and diplomacy is not new; rather, it proves how agile diplomacy has been. According to Manor and Segev (2015), digital diplomacy may be defined as the execution of foreign policy using digital tools, such as social media platforms (Twitter and Facebook). However, 4IR has prompted an even more intensive use of digital tools and applications. The characteristics of 'old' and 'new' diplomacy are set out in the following table.

Table 1: Key features of old and new diplomacy

Characteristics	Old diplomacy	New diplomacy
Date	700BC- 1914	1919-Present
Nature	Closed	Open
Communication	Physical missions	Physical missions, telephonic calls, email.
Interdependence	Low levels of interaction, alliances. Bilateralism. The state is the primary actor	Multilateralism – states, non-state actors like international organisations and non-governmental organisations
Legislation	Congress of Vienna	Vienna Convention of Diplomatic Relations of 1963
Main Actors	Professional diplomats	Diplomats, international organisations.
Functions	To represent the state and achieve the foreign policy goals of the state.	To represent the state and achieve the foreign policy goals of the state.

Source: The central features of old and new diplomacy (Williams 2021).

New-new diplomacy: a new dawn

The continued penetration of advanced technologies into diplomacy and diplomatic relations marks a new era of diplomacy. Technologically speaking, the world is more interconnected now than ever before. Lines of distinction have faded over time, and this has implications for diplomacy. History has twice demonstrated that diplomacy may develop into a new phase due to new international trends, norms, and characteristics. Aspects of the latest phase are explored below.

Communication

According to Pilegaard (2017), emerging technologies will continue to influence the diplomacy into the future. The United States was one of the first countries to realise that technology could play a significant role in international relations, leading to the launch of several Virtual Presence Posts (VPPs), including Russia and the Maldives. VPPs are digital

extensions of diplomatic services and ease access to diplomatic information utilising ICT in the absence of physical embassies (Congressional Service Report 2019). Furthermore, VPPs allow diplomatic engagement to occur in smaller and more remote but significant regions.

New technologies, like big data, can be used to enhance traditional diplomatic functions, such as information-gathering and data analysis, leading to more rapidly assembled and more accurate information, and therefore improved service delivery (Hocking and Melissen 2015). These improvements may have major positive impacts in the areas of crises management and bilateral conflict. Moreover, the vast quantum of information provided by big data may result in faster and more appropriate decision-making in the wake of a crisis (Mazoni 2017).

Emerging technologies, and specifically ICT, enhance horizontal engagements, allowing citizens and other non-state actors to engage widely on online social media platforms such as Twitter and Facebook (Bousfield 2019). These engagements mostly occur irrespective of state laws. However, some states have imposed a ban on some platforms. and closely monitor online engagement. Internet censorship has become common practice in Iran, where the government intermittently shuts down the internet == notably during the 2019 anti-government protests. However, this is not a new practice. In 2011, a few days after the launch of the US virtual embassy, Iran shut down the website in a hasty response to conflict (Reuters 2011).

ICT may further allow users or states to outpace their opponents. In 2014, during the #Occupycentral protests in Hong Kong, citizens feared the government would shut down the internet in order to disrupt communication among protestors and also their communication with the international community. However, use of the mobile application FireChat allowed protestors to communicate offline (Boehler 2014).

Lithuania has made a significant effort to utilise social media, notably Twitter, for foreign policy purposes (Dumčiuvienė 2016). The governments has created a Twitter account, *Twiplomacy*, aimed at publicising and advancing its foreign policy objectives, and building the image of the state. Linus Linkevičiu, a cabinet minister, tweets every day, sharing the state's objectives and posting upcoming events. Besides the accounts of Lithuania's foreign ministers and diplomats, diplomatic missions also have Twitter accounts.

The Chinese government has also begun to use Twitter, despite the fact that it is blocked in China. Various government representatives have official Twitter accounts, which have been described as 'confrontational' and 'informal'. In a virtual quarrel in 2019, a Chinese minister made allegations about racial discrimination experienced in Washington. Susan Rice, US ambassador to the UN, took umbrage, and called the Chinese official a 'racist disgrace' (*Bangkok Post* 2020). China was urged to utilise Twitter due to the increasingly adverse portrayal by the foreign media of the ongoing trade dispute between the US and China; the mass detention of Muslims in Xijiang; US President Donald Trump's active use of Twitter; and the pro-democracy movement in Hong-Kong.

While increasingly popular, e-diplomacy is still in its infancy (Hare 2016: 289). Emerging technologies have become a useful tool for diplomats. E-diplomacy comprises the use of the internet and ICT to achieve diplomatic goals, including the digitisation of diplomatic practices and processes. According to Hanson (2012), it aids in information and knowledge management, public diplomacy, and disaster response.

Social media are widely considered to be the sole tool of e-diplomacy, but this is not the case. Crowd-sourcing, computer and mobile technology, mapping software, and text messaging all contribute to highly digitised and efficient e-diplomacy. Moreover, e-diplomacy is far cheaper than traditional diplomacy. Over the past five decades, the costs of computers, mobile devices and communication technologies have dropped dramatically, making these technologies more affordable and accessible to states, organisations and individuals Hare (2016). This has helped to open up diplomacy, as non-state actors have been drawn into diplomatic engagements, and states have become more responsive to citizens.

The rapid development of ICT has also required diplomacy to adapt to it as rapidly (Hare 2016). Continuous adaptation is difficult and time-consuming, with diplomats and other actors have to continue learning new skills and assimilating new knowledge.

According to Kurbalija (2013), the implications of e-diplomacy include the following:

1. Continuously developing emerging technologies have resulted in an ever evolving diplomatic environment, with further effects on the global economy;
2. Traditional diplomatic practice has transitioned to online spaces, and states have become increasingly reliant on the internet and further concerned with internet governance; and
3. Diplomatic agents should familiarise themselves with new tools and begin integrating these into diplomatic practice. Big data, natural language processing and social media can all enhance diplomatic activity.

E-diplomacy may be applied in many ways. In the wake of a crisis, whether man-made or natural, advanced ICTs allow for instant communication. Through emails, online meeting applications and social media, states have an instant and consistent channel of communication at their disposal. Emerging technologies also allows policy-makers, heads of state and diplomats to make informed and accurate decisions at a quicker pace. Kurbalija (2013) further states that digital tools allow citizens to be drawn into decision-making processes about foreign policy and diplomacy.

Al-Muftah et al (2018) conducted an extensive study of the social, political and economic factors that may hinder the implementation of e-diplomacy. Hindrances included resistance to change, secrecy, and a lack of financial resources. Many diplomats still prefer more private forms of diplomacy, and are therefore reluctant to engage in open diplomacy on social media, for example. Some diplomatic work involves sensitive information. Moreover, the integration of complex processes may make traditional positions and departments obsolete. For these and other reasons, diplomats and those who work within diplomatic institutions may be resistant to change. Some states also lack the financial resources to implement emerging technologies. Lastly, states may believe that e-diplomacy is not really essential, and prioritise spending on other areas of activity. They may therefore choose to not upgrade to newer, more advanced systems, thereby deferring the implementation of e-diplomacy.

Several significant changes must occur for diplomacy to remain relevant in a highly digitised environment (Tavares 2018). On the positive side, e-diplomacy can enhance accountability, and promote a positive reflection of the state. New ICT that are accessible to both private individuals and the state offer risks and opportunities for relations within and among states. It can significantly broaden access, allowing states to engage with foreign audiences and promote educational opportunities and visa applications through their websites. On the other

hand, it also provides new opportunities for attacks on the state. After a series of air strikes and ongoing tensions between the Unite States and Iran in early 2020, a private Iranian group utilised video distortion tools to create a deepfake of then US president Donald Trump. The video depicted a beaten and bruised Trump, along with a message that vowed to seek revenge for the death of Qassem Suleimani (France-Presse 2020).

The Fourth Industrial Revolution also enables and promotes sentiment analysis. This is an algorithmic process that allows governments to develop a deeper and more accurate understanding of public opinion (McLellan 2017). Sentiment analysis efficiently processes real-time data during crises, or as vote counts take place during elections. Due to its volume, velocity and variety, Twitter is an ideal platform for sentiment analysis. It enables states to rapidly process the opinions of domestic and/or foreign audiences.

The British government has begun to use Latent Dirichlet Allocation (LDA) to deepen its understanding of public opinion. LDA is similar to sentiment analysis as it establishes 'structured latent patterns from a sea of unstructured data' (Williams 2021: 80). According to Killbride (2020), sentiment analysis allowed a British organisation, Aylien, to analyse public opinion about Brexit. All news items about Brexit were collected. Positive and negative articles were separated, and the findings were numerically illustrated on a graph. The study explored both media within the United Kingdom and foreign media.

According to Gracie et al (2019), a special unit of the US Department of Defense, the Defense Advanced Research Projects Agency (DARPA), gathers and interprets big data to gauge threats and contribute to mission planning. It pulls a mass of data from different social media platforms, official websites and field reports. To ease the process and improve the potential results, DARPA created a Deep Exploration and Filtering of Text (DEFT) program, which utilises Natural Language Processing (NLP) to extract data automatically. This can be analysed and can help decision-makers to make more informed decisions.

Who are the diplomats?

While the role of diplomats has remained much the same, the individuals who represent the state or engage in international relations have evolved. According to Bull (1977), diplomats are responsible for forging and maintaining relationships among various acdtors, promoting the values, norms and rules of the state within international society. Charisma, non-bias, patience and fluency in several languages were widely regarded as the primary characteristics of a good diplomat (Nicolson 1998). Diplomats also need negotiation and mediation skills, the ability to protect the interests of the state and citizens in the diaspora, and the ability to gather, analyse and distribute information. Ambassador Al-Alawi (2019) has acknowledged the evolution of technology and its inclusion in diplomatic activities, stating that diplomats ought to learn more about data mining and should possess the ability to process much larger quantities of information.

Advanced technologies could benefit diplomats on a daily basis, helping them to do more in shorter periods. They can now micro manage their tasks, relations and information irrespective of time and distance, which would previously have been inhibiting factors (Hutchings and Suri 2020). On the other hand, as information is readily and publicly available, the reporting task of a diplomat may diminish. With the internet available just about anywhere in the world, and most citizens on social media, news about natural disasters, terrorist attacks, international political developments, and so on is almost instantly available. Therefore,

diplomats have far less time than previously to prepare a report about or response to breaking news. However, they still need to confirm the facts or accurate accounts of the events in question, as information can easily be falsified.

AI could drastically ease and enhance the daily activities of diplomats. According to Le Meir (2016), hashtags categorise subjects on social media in simple ways, thus allowing diplomats to easily access citizens' views on particular topics. AI may also improve negotiations and their outcomes, as it could help diplomats to analyse past experiences and explore alternative outcomes instead of making decisions based on insufficient facts and limited understandings (Grottola 2018). While it is evident that emerging tools may enhance the daily operations of a diplomat and speed up diplomatic processes, Cranston (2011) expresses concern over the costs of training diplomats to use these new tools. Moreover, given that digital technology is constantly advancing, diplomats would need to be almost continuously trained and retrained. Tavares (2020) points to the importance of companies such as Swissnex, a global science and technology initiative tasked with training diplomats in new technology, and providing them with innovation-related knowledge and skills. This is an attempt to ensure that diplomats are well equipped to deal with digital challenges, and able to utilise the new technology to improve international relations.

Interdependence

Diplomacy is more open than ever, and openly invites a multitude of actors to play an active role in diplomatic relations. States need one another, and the new technologies hold great promise for global development. While science diplomacy is not a new term, it is evolving and becoming more relevant. Described as 'scientific collaborations among states' (Hennessy, quoted in Williams 2021:46), it offers states new opportunities for addressing global challenges such as food insecurity, pandemics like Covid-19, and climate change. Science diplomacy has continued to evolve since the 1940s, when multilateralism began to develop more rapidly, and international conferences like the United Nations Climate Change Conference and the International Conference on AIDS and Sexually Transmitted Infections in Africa (ICASA) include discussions on how countries can utilise scientific collaboration to address global challenges. Diplomatic activities around science and technology include science exchange programmes and international webinars aimed at exploring joint solutions to global challenges

Legal frameworks

For decades, diplomatic activity has been governed by a single document: the Vienna Convention on Diplomatic Activity of 1961. As noted previously, diplomacy has evolved in leaps and bounds, in lockstep with international trends and technological innovations, but the Convention has not been changed in line with evolving diplomatic practices.

Exponential technological development present states with significant and sustained foreign policy and security challenges (Turekian 2017). Therefore, states have to engage and collaborate on where to draw the line when implementing technology for diplomatic purposes, and define rules and norms for a digitised diplomatic environment. Frameworks have been developed for governing the international weapons trade and the spread of advanced technologies, it has been suggested that these should be extended to diplomatic practice as well. Given that these frameworks are general and non-specific, some territories and activities might not be covered.

While this may be suitable in the realms of war and cybersecurity, there are unanswered questions about what it means for Twitter diplomacy, internet bans that discourage freedom of speech, and the close examination of citizens' tweets by governments.

AI is highly complex and developing continuously, and has already injected itself into communications, military affairs, and international relations. According to the Group of Governmental Experts (2019), legislating AI should not be undertaken by coders and scientists alone, but should be a large collaborative effort involving social scientists, policy-makers, and originators of the technologies themselves. Involving all key actors in drafting new legislation for technology in international relations would ensure that all relevant aspects of diplomatic practice are considered. Besides drafting the legislation, overseeing the implementation of AI and ensuring that it does not breach any regulations is also a very important dimension.

According to Edelman (2020), states ought to acknowledge the potential of AI. Moreover, it is not AI itself that should be regulated, bur rather its implementation. States would benefit by adapting AI policy at a national level to ensure its efficacy in both the public and private sectors. States should explore existing technology-related international frameworks and tailor them to suit diplomatic practice at an international level. This technique would offer states an existing policy foundation to work with. However, a general adaptation would not be advisable, and area-specific policy should be considered.

The Governance of International Spaces is legislation that attempts to regulate areas beyond national and traditional borders. These include outer space, Antarctica, and the high seas (The Royal Society 2010). It is impossible to traditionally govern international spaces, and agility is a notable trait that may ease the governance approach. States' multilateral cooperative approaches may aid in international space governance if it is done through scientific evidence and partnerships underpinned by science.

States such as Russia and the United States have begun to incorporate advanced technology and robotics in military practice. However, Russia has been more advanced and has openly stated that unmanned robots will soon replace human soldiers, and will be stronger, faster and more accurate (Spry 2020). The use of robots may also have negative consequences for international security, and may contravene Article 2.4 of the United Nations Charter that covers the timely and peaceful resolution of conflicts. There are various discussions surrounding the use of AI, particularly in global security. Singer (2009) has asked whether an AI-steered arms race should be halted before it gains momentum, and whether state-of-the-art technology (AI) should be allowed to destroy and kill in the absence of human input. Kirkpatrick (2016) believes weapons should not operate autonomously, and should require continued human input. These considerations should be taken into account in updating or creating new legal frameworks. The absence of human input could also raise questions about accountability when errors are made.

While there are numerous conversations around militarised AI, legislation aimed at governing its entry into global politics and international security is still lacking. In addition, AI is developing more and more rapidly, making it difficult for states to keep up and draft effective and relevant legislation (Michaelsons nd). Furthermore, while there is an urgent need to create an international framework for AI, policy-makers ought to strike a balance between encouraging innovation and protecting citizens. The UN has a notable history of establishing legal frameworks around new and advancing technology, including the Universal Declaration on the Human Genome and Human Rights (1997), and the Universal Declaration

on Bioethics and Human rights (2005). In the last few years, the UN and its advisory bodies have been working on a declaration about the application and ethics of AI.

Garcia (2019) notes that militarised AI technology and robotics may infringe existing frameworks, inciting more violence. On the other hand, Kirkpatrick (2016) points out that, as AI becomes more advanced, its accuracy is improved and less emotion is involved, which means that violence and disaster are less likely to occur. Most importantly, as policy-makers and scientists convene to formulate more up-to-date legislation surrounding AI, innovation and agility are principal considerations.

A new dawn

Research and analysis shows clearly that diplomacy remains relevant, but has evolved significantly due to the influence of advanced and emerging technologies that affect how tasks are performed, how humans engage, and offer new threats and possibilities.

Table 2: The three phases of diplomacy

	Old diplomacy	New diplomacy	New 'new' diplomacy
Date	700BC-1914	1919-2020	2020-
Nature	Closed	Open	More open
Communication	Physical missions	Physical missions, telephonic calls, email.	Physical missions, telephonic calls and social media.
Interdependence	Low levels of interaction, alliances. The state is the primary actor	Multilateralism– states, non-state actors such as international organisations and non-governmental organisations.	Multilateralism– states, non-state actors. Public citizens, businesses, interest groups.
Legislation	Treaty of Westphalia of 1648. Congress of Vienna of 1814.	Vienna Convention of Diplomatic Relations of 1963.	Vienna Convention of Diplomatic Relations of 1963– falls short in some areas.
Actors	Professional diplomats	Diplomats, international organisations	Diplomats, IOs, media, public, businesses, interest groups
Functions	To represent the state and achieve the foreign policy goals of the state.	To represent the state and achieve the foreign policy goals of the state.	To represent the state and achieve the foreign policy goals of the state.

The central features of old, new, and new 'new' diplomacy (Williams 2021).

'New-new' diplomacy is still in its infancy, but has already demonstrated how it differs from previous phases. It is more open than before, welcoming more non-state actors than new diplomacy, and very different from old diplomacy, which was highly secretive and closed off. Communication has evolved far beyond the early stages of diplomacy when physical missions, letters, and later telephone calls were the most common forms of engagement. In the last few years, we have witnessed a major development with states beginning to utilise social media to forge closer relations citizens in their own and other countries, but also to engage with heads of state and diplomatic representatives. Evidently, the use of social media is not directly related to the 4IR, and some may argue that relying on online applications such as Twitter and Facebook would have occurred irrespective of 4IR. However, tools such as natural language processing, the use of Hashtags to group and themes and discussions, and sentiment analysis may further spur the use of social media, as it allows states to develop a greater understanding of the views of citizens.

The new sense of openness and interdependence involves a plethora of new actors apart from the traditional states, international organisations and non-government organisations included in the new diplomacy. New actors include citizens, private businesses, scientists, innovators, universities and interest groups. The Vienna Convention on Diplomatic Relations of 1961 has served as the sole international framework for all three phrases of diplomacy. However, as could be expected, it now falls short in various new areas, including territorial boundaries, cyphers and coding, that could have security implications. Diplomacy has also extended far beyond traditional diplomats and now include a range of actors who represent the state and engage in diplomatic activities at various levels. The crucial point is that diplomats are more relevant than ever. As noted previously, the world is highly integrated, and messages are easily lost in translation. While traditional characteristics – including certain personality traits -- remain useful, diplomats today must be agile, able to adapt to the changing nature of diplomatic relations, and able to stay abreast of the new technologies that are rapidly being integrated into diplomatic practice.

This article has attempted to fill a gap in the literature by reviewing the intersection of the 4IR and diplomacy. In the process, it has sought to provide a conceptual framework for a new era in diplomacy and international relations. As critically explored throughout the article, the terrain of diplomacy is shifting continuously, and new practices are developing that do not fall under traditional diplomatic practice, making it necessary to offer a new frame. However, traditional diplomatic practices are still reflected today, presenting us with a mix of old and new diplomacy in current international relations. Therefore, the 'new-new' diplomacy does not erase the previous two phases, but rather constitutes an additional phase in which modern, digitised and 4IR-driven diplomatic actions come to the fore.

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Internet blackouts in Africa

A critical examination, with reference to Cameroon and Nigeria

Floribert Patrick C. Endong
Media Arts, University of Calabar
floribertendong@yahoo.com

Abstract

Internet blackouts in Africa have largely been examined through the prisms of human rights and economic development. This has resulted in highly negative assessments; Internet shutdowns have widely been branded as violations of the rights of African citizens, and the bane of economic development. However, while unarguably extreme, Internet blackouts are not necessarily unjustified or unwarranted. Even influential bodies such as the International Telecommunications Union (ITU) recognise the need to shut down the Internet under certain circumstances. Governments often justify Internet shutdowns by citing principles or values that are valid in principle. These include protecting their sovereignty, combating 'rascality' among telecom operators, and maintaining peace and security. Given this, it is important to examine the extent to which Internet shutdowns in Africa have been justified, or whether they have been used to advance authoritarian rule. To this end, this study uses documentary analysis and critical observations to explore the morality of Internet blackouts in sub-Saharan Africa, and specifically whether or not the recent shutdowns in Cameroon and Nigeria have been justified.

Keywords: Internet censorship, Internet blackout, cyber sovereignty, human rights, online movement, authoritarianism, social responsibility.

Introduction

The emergence of Internet blackouts in Africa has largely been examined through the prisms of human rights and economic development. This has resulted in highly negative assessments, with scholars typically branding internet shutdown as violations of the rights of African citizens, and the bane of economic progress (Allen & Van Zyl 2020; Marchant & Stremlau 2019). Essentially, human right activists and researchers argue that Internet shutdowns are inherently illegitimate and unwarranted. Thus Stauffer (2020) argues that even when Internet blackouts are justified in principle, they end up being more of a collective punishment than a tactical response. To him, these shutdowns are sweeping measures that end up paralysing industries and even entire cities and countries. Similarly, Nyokabi et al (2019) observe that Internet blackouts are clear violations that impede people's right to development, and pose threats to democratic development in African countries. While some authors attack Internet shutdowns on the grounds of human rights, others anchor their negative arguments on the economic consequences (CIPESA 2021; Taye 2019; Kathuria et al 2018).

In a study published in 2016, Darell West critically analysed 81 short-term Internet shutdowns in 19 countries, and found that, between 1 July 2015 and 30 June 2016, these shutdowns came at a cost at least US$2.4 billion in Gross Domestic Product (GDP).

According to a more recent report by the Top10VPN (cited by Lamensch 2021), the cost of Internet shutdowns in 2020 was $4 billion, a huge increase since 2016. The report also revealed that even countries with low levels of Internet connectivity can lose as much as $3 million a day (Lamensch 2021). Thus, there has been a sustained trend among scholars and human right activists to emphasise the negative aspects of Internet blackouts, and present them as exclusively negative strategies.

However, while undeniably extreme, Internet blackouts are not inherently illegitimate or unwarranted. Even influential bodies like the International Telecommunications Union (ITU) recognise the need for Internet shutdowns in certain specific situations (ITU 2017). Also, many governments that have ordered Internet shutdowns have justified them in terms of principles or values which, in theory at least, are valid or pertinent. Three such values are the protection of their sovereignty, the suppression of 'rascality' by telecom operators, and the need to counter social instability. While De Gregorio and Stremlau (2020) note that governments often do not provide employ legally valid frameworks for shutting down the Internet, or provide valid reasons, they recognise that, in some cases, blocking access to the Internet can be justified. They write: 'States cannot control the circulation of online content without regulating it, because only social media govern the digital spaces where information flows online [...] The only way states can intervene to face protests or the spread of hate and violence online in the absence of concerted cooperation from social media companies is by shutting down the entire network or specific websites' (p 4229).

In view of the foregoing, it is important to examine the extent to which Internet shutdowns in Africa have been warranted, or misused for political purposes. This is timely, as this issue has not been adequately researched. This paper uses documentary analysis and critical observations to explore the morality of Internet blackouts in sub-Saharan Africa, and to examine the extent to which the recent shutdowns in Cameroon and Nigeria have been justified. It thus attempts answer the following research questions: What are Internet blackouts? When are they legitimate? How have African governments used Internet shutdowns over the past five years? And to what extent can the recent shutdowns in Cameroon and Nigeria be regarded as justified?

Rationalising Internet blackouts

Internet blackouts – also called Internet shutdowns, digital curfews or 'kill' switches – refer to situations when the Internet, mobile networks and electronic communications are intentionally disrupted by either government or non-state actors, usually for the sake of suppressing or controlling the free flow of information (De Gregorio & Stremlau 2020; Nyokabi et al 2019). The Internet then becomes inaccessible to by the population of a specific locality or country. Technically, the term 'Internet shutdown' is an exaggeration, since it is impossible to shut the Internet down entirely. As Nyokabi et al (2019) explain, the Internet has a complex architecture that makes it difficult for any agent or entity to shut it down completely. It is a loose medium. In view of this complexity, some analysts prefer the term 'network disruption'.

There are various types of Internet blackout, depending on their duration, geographical coverage, and the specific communications networks affected. As explained by IFLA (2020), a shutdown may be limited to a specific area and a specific period, while another may last indefinitely. Also, an Internet blackout may be limited to the mobile Internet used on smartphones, the wired broadband that usually connects a desktop, or both. Moreover, an Internet shutdown may be deployed for legal reasons, while another may be caused by technical factors. The reasons commonly advanced by governments for shutting down the Internet include the following:

- Dealing with social unrest in their areas under their jurisdiction. This reason is often advanced when government are faced with social protests that are spiralling out of control.
- Blocking avenues for foreign propaganda.
- Checking perceived social media 'rascality'. This happens when governments seek to punish messaging services for not agreeing to block online content deemed harmful and a threat to national security.
- Achieving a particular policy goal. This happened in Ethiopia in when the government shut down the Internet to 'relieve stress' and stop students from cheating in exams (IFLA 2020, Kaye 2016).
- Maintaining law and order.

As noted earlier, the dominant tendency among researchers and rights organisations has been to present Internet shutdowns as violations of various human rights, notably the rights to freedom of expression and access to information. However, there are specific reasons why digital curfews are sometimes warranted or justifiable. The first has to do with the fact that Internet or digital communication networks should not be used in an irresponsible way. While recognising freedom of expression and opinion as a fundamental human right, the International Covenant on Civil and Political Rights (ICCPR) clearly states that this right is associated with duties and responsibilities which, when not satisfied, may justified censorship. The ICCPR states that:

> The exercise of the rights provided [...] carries with it special duties and responsibilities. It may therefore be subject to certain restrictions but these shall only be as provided by law and are necessary: (a) For respect of the rights or reputations of others, (b) For the protection of national security or of public order, or of public health or morals (IFLA 2020: 5).

In the same vein, the constitution of the International Telecommunications Union (ITU) states: 'Member states also reserve the right to cut off, in accordance with their national law, any other private telecommunications which may appear dangerous to the security of the State or contrary to its laws, public order or decency.' However, it does not clearly define key terms such as 'appear dangerous' and 'decency'.

Various authors recognise that digital curfews may be necessary in certain circumstances, but lament the fact that, in most situations, governments do not adopt formal and credible legal

frameworks for defining and managing Internet shutdowns. This tends to detract from the legitimacy of their actions. For example, De Gregorio and Stremlau (2020: 4228) argue that:

> There is a clear lack of transparency and accountability of states when shutting down the Internet, including justification of the reasons or the procedures on which these restrictive measures are implemented [...] Despite the differences in various narratives for justifying shutdowns, one goal appears to be the 'sabotaging of accountability' by relying on general justifications without a strong legal basis and proportionality assessment on which shutdown orders could be based.

De Gregorio and Stremlau also underline the fact that even when a shutdown has become necessary, it is the government and not an independent body that is generally saddled with the responsibility to establish this necessity. Meanwhile, governmental approaches to establishing this necessity are rarely transparent. They write:

> Although democratic states are usually inclined to provide a higher degree of transparency and accountability about the reasons behind Internet shutdowns, the general absence of government transparency makes the entire situation extremely opaque because information about Internet shutdowns comes primarily from the same officials who have been responsible for the shutdown. As a result, understanding the true reasons and consequences of Internet shutdowns, and, in particular, how and to what extent human rights are affected, is not usually an easy task. (p.4228-4229)

The culture of 'sabotaging accountability' seems more pronounced in Africa. This will be addressed in greater detail below.

Internet shutdowns in Africa

Internet shutdowns have become increasingly prevalent in today's world, probably because of the growing digitalisation of industries. According to KeepItOn, an international organisation that tracks global Internet shutdowns, there were 213 incidents of Internet blackouts in 2019, and the number of countries that shut down the Internet increased from 25 in 2018 to 33 in 2019 (Tayo 2019). This confirms previous findings by Access Now that, from 2016 to 2017, the number of global Internet blackouts rose from 75 to 188.

Digital curfews aimed at controlling the Internet have been utilised by countries in the developed and developing world. But Africa seems to have become a major breeding ground for the Internet 'kill switch' phenomenon. According to KeepItOn, Internet shutdowns in Africa increased by 47 per cent from 2018 to 2019 (Tayo 2019). In tandem with this, Nyokabi et al (2019) argue that the growing number of Internet blackouts in Africa is connected to the rise and dominance of undemocratic cultures in various African countries. As they put it, the peculiarities of Internet shutdowns in Africa 'have been linked to countries with records of human right violations and protracted authoritarian practices in the region' (2019: 151). These include Chad, which on 28 March 2018 started a digital curfew that lasted more than a year. They also cite the case of Cameroon, which since 2017, has sought to repress secessionist agitation by enforcing a series of Internet blackouts in its Anglophone regions. Similarly, on the eve of its 14 January 2021 elections, the Ugandan government blacked out

the Internet, with the clear purpose of allowing the incumbent president, Yoweri Museveni, to control the political discourse and influence voters (Lamensch 2021).

An additional case is Ethiopia, where the government of Abiy Ahmed has been using regular Internet disruptions to silence opposition movements and undermine peaceful assembly. The Abiy government's resort to Internet blackouts has also been aimed at preventing the international community from gaining information about the insurrection in Tigray where, according to many observers, government forces have been committing human rights crimes (Lamensch 2021; Stauffer 2020). Other African countries that have recently resorted to Internet disruptions include Gabon, Benin, Liberia, Eritrea, Mauritania and Zimbabwe. Nyokabi et al (2019) note that most of these governments are struggling to repress or neutralise politically hostile social movements. As they put it, 'the connection has been a leader who will not relinquish power and who has therefore grown more powerful and later fearful of the rallying power of the Internet for citizens' organisation against their rule' (p 151). Similarly, the Media Foundation for West Africa (2018) has observed that although most African governments justify their recourse to Internet shutdowns by the need to maintain ensure national peace and security, their real motives are usually political, aimed at muzzling opposition voices and letting various forms of authoritarianism prevail. It adds: 'Such excuses are, at best, a convenient subterfuge, as the real reason for the disruptions and shutdowns has often been the desire by incumbent governments to mute dissenting voices and maintain power' (ibid: 3).

However, not only traditionally undemocratic countries are resorting to shutting down the internet – they also include supposed model democracies, such as Ghana. Ahead of the 2016 presidential and parliamentary elections, the Ghanaian government threatened to shut down social media. This provoked a storm of protest from pressure groups, civil society organisations, the media and other stakeholders, which forced the government to abandon the idea. The threat had been averted, but the fact that the Ghanaian government contemplated such an undemocratic strategy showed that even models of democracy in Africa are not immune from the 'Internet shutdown mania'.

Moreover, the number of states adopting this practice is growing. According to KeepItOn, of the 14 African countries that shut down the Internet in 2019, at least seven -- Benin, Gabon, Eritrea, Liberia, Malawi, Mauritania and Zimbabwe -- had never done so before, or had not done so in 2018. This is another indicator that Internet shutdowns on the continent are proliferating rapidly. Besides the number of countries resorting to shutdowns, they have also grown in terms of magnitude. According to KeepItOn:

> In contrast to Asia, the majority of the shutdowns in Africa were not targeted to a specific location or minority groups, instead impacting entire countries. Out of the 25 shutdowns recorded in Africa in 2019, 21 affected either an entire country or at minimum multiple regions and provinces. It is only in three cases that a shutdown targeted a specific region, city, or province. One example is a targeted shutdown that was carried out in Ethiopia. This indicates that shutdowns are not only growing in number but are also expanding in scope and affecting more and more people in Africa (quoted in Taye 2019: 6.)

Reasons advanced by African governments for shutting down the Internet usually centre on the need to maintain peace and protect national security. But most observers claim that this rhetoric is a pretext, concealing a desire to entrench authoritarian rule. For instance, Nyokabi et al (2019) argue that most African governments are unable to provide legitimate

reasons for resorting to Internet blackouts, and the initiatives are therefore mostly illegal. De Gregorio and Stremlau (2020) similarly argue that Internet shutdowns in African countries are differentiated from those in western democracies by their gross illegality. While western democracies provide reasons for their actions, and adopt them as temporary measures to deal with specific emergencies, authoritarian African states address Internet shutdowns in ad hoc ways, and rarely base their actions on evidence or data. 'As a result, they cannot justify their rationale' (De Gregorio and Stremlau 2020: 4228).

The Cameroonian and Nigerian experiences

Since 2000, Nigeria and Cameroon have witnessed growing Internet and social media penetration. According to Internet World Stats (2020), Nigeria and Cameroon have respectively enjoyed an Internet growth of 62.93% and 39.29% from 2000 to 2020. According to NoiPolls (2020), 61 per cent of Nigerians and 29 per cent or Cameroonians have access to the Internet. As could be expected, this is concentrated in the urban areas. The most used social media in these two countries are Facebook, YouTube, Twitter, Instagram and WhatsApp (Statistica 2020). According to Statcounter (2022), social media use in Cameroon is as follows: Facebook: 89.31 percent; Pinterest, 5.18 percent; YouTube, 2.57 percent; Twitter, 19 per cent; Instagram, 0.46 percent; and LinkedIn, 0.12 percent. Trends in Nigeria are similar, as shown in Table 1.

Table 1: Use of social media in Cameroon and Nigeria, December 2020 to December 2021 (% of total)

No	Name of Social Media	Country	
		Cameroon	Nigeria
1	Facebook	89.31	83.29
2	Pinterest	5.18	3.22
3	YouTube	2.57	2.72
4	Twitter	2.19	5.65
5	Instagram	0.46	4.57
6	LinkedIn	0.12	0.31

Source: Statcounter 2022.

As elsewhere, the proliferation of the Internet and social media in these two countries has revolutionised human industries, from commerce through education to administration. It has also triggered the emergence of various digital cultures, including hash tagging, online protests, cyber terrorism, and adversarial citizen journalism, which the Cameroonian and Nigerian governments have sought to control. Since 2011, online protests in particular have been leveraged by political activists in the two countries to agitate for the recognition of specific human rights as well as democratisation. In Nigeria, popular online-based campaigns such as the 2011 Occupy Nigeria, the 2014 #BringBackOurGirls and the 2019 #EndSars have been mounted for democratisation purposes. These online protests are similar to the #BringBackOurInternet, the #FreeMiniMefo and the #FreeAllArrested movements in Cameroon. Separatist groups such as the Indigenous People of Biafra (IOPB) of Nigeria and the Ambazonia Defence Force (ADF) of Cameroon have capitalised on the loose nature of the Internet to initiate various forms of online anti-government campaigns which have seriously tested the nerves of the Nigerian and Cameroonian governments.

The aggressive and disruptive nature of this digital activism has in provoked the ire of the Cameroonian and Nigerian governments. This has led to sweeping censorships, including the partial or widespread Internet blackouts. Thus the disruption of the Internet has become the method par excellence for taming activist and politically disruptive movements.

The case of Cameroon

Internet shutdowns in Cameroon dates back to 2011 when the Cameroonian government blocked the 'Twitter via SMS' service provided by a local telecommunication operator. Enforced on 8 March of that year, this came while the country was preparing for general elections and amid suspicions that the opposition was planning 'Egypt-like' mass protests against the Biya regime.

In effect, the government banned the service on the basis that it could trigger a serious threat to national security on the eve of the elections (Kaye 2016). This action fuelled heated debates within Cameroon, and was condemned by international observers such as Reporters Without Borders, Internet Without Borders and Access Now. Reporters without Borders lamented that the measure was too extreme to 'correct' acts that qualified more as 'peaceful expressions of opinion' (cited in Miles 2011, Access Now 2018). Other international observers quickly interpreted the social media shutdown as the harbinger of more extreme actions aimed at intimidating and repressing opposition.

Despite all this, the Cameroonian government embarked on another Internet shutdown which lasted from 17 January to 20 April 2017. This was in response to the vitriolic online propaganda of a secessionist and separatist movement led by armed groups based in the English-speaking regions of Cameroon. The shutdown, which lasted for 94 days, only affected the English-speaking parts of the country. These include the North West and South West regions where various separatist groups – notably the Ambazonia Defence Forces, the Red Dragons and the Ambazonia United Front – had taken up arms against government security forces and destroyed public institutions in what became known as the Anglophone Crisis, or the Ambazonia War. The separatists have since 2016 sought to create a breakaway state by force of arms, and have supplemented their guerrilla/military activities with online propaganda campaigns. These campaigns, together with the usual anti-government discourse of political activists, prompted the Cameroonian government to shutting down the Internet and to embark on various other forms of Internet censorship.

Therefore, the Cameroonian government shut down the Internet in a bid to contain the online spread of harmful propaganda by the separatists and their allies. The Minister of Posts and Telecommunications provided the following justification: 'Social media have become an important communications instrument, which unfortunately is used by people with evil intention to propagate false information [in order] to threaten the public and create panic' (cited in Caldwell 2017).

The shutdown triggered the formation of counter-movements aimed at condemning the shutdown and challenging the Cameroonian government on its approaches to Internet censorship. Access Now and Internet Sans Frontières launched legal actions against the Cameroonian government, and the #BringBackOurInternet movement disseminated various narratives about the destructive effects of the shutdown in Anglophone Cameroon. After intense pressure from both local pressure groups and the international community, the Cameroonian government lifted the shutdown, but stated that it would be reinstated if

online anti-government and separatist movements were reactivated. The Minster of Posts and Telecommunications, Libom Li Likeng, warned: 'Our security forces have platforms to track and control people just as in all other countries of the world' (cited in Caldwell 2017).

Despite international condemnation of the January–April 2017 digital curfew, the Cameroonian government enforced a renewed Internet blackout six month later. This shutdown, from October 2017 to March 2018, exacerbated the damage done by the first. Technically, it realised the government's previous threat that the blackout would be reimposed if the inhabitants of the English-speaking regions continued to use the Internet to spread fake news, anti-government discourses and separatist propaganda. The new shutdown triggered a new wave of indigenous and exogenous pressure aimed at compelling the Cameroonian government to lift the shutdown.

The case of Nigeria

Nigeria has had its own dose of shutdowns. The first came in 2015, prior to the general elections. In February, the Nigerian telecommunication regulatory organ, the NCC, shut down an SMS short code used by the opposition political party, the All Progressives Congress, for the purposes of fund-raising. This happened during the electoral campaign, and the Nigerian public widely viewed the initiative as being politically motivated (Freedom House 2016; Media Foundation for West Arica 2015). The Nigerian government also placed temporary restrictions on connectivity in a bid to combat the Boko Haram insurgency in a number of northern Nigerian states. From 2013 to 2014, it instituted a series of telecommunications blackouts in the north eastern states of Borno, Adamawa and Yobe, as a war strategy against the Islamist insurgents. The blackouts lasted from May to December 2013, and were repeated in March 2014. Though the reason provided by the government – that of combating terrorism –- might have been genuine, the shutdown disadvantaged the general public more than the targeted insurgents. Among others, Freedom House (2015) noted that the shutdowns placed many civilians in harm's way, with citizens travelling to neighbouring states in search of mobile phone or Internet connectivity became easy prey for the insurgents. They were often ambushed and killed.

The Nigerian government imposed another Internet blackout in northern Nigeria in February and March 2021. This shutdown, which only affected the state of Zamfara, was aimed at assisting a military operation against bandits and ransom-seeking kidnappers that had become rampant. It came a few days after 73 students had been abducted from a government school in the state. This abduction was just one in a long string of kidnappings that had plagued the state. Thus the Nigeria Communication Commission stated that the shutdown was aimed at 'enabling the relevant security agencies to carry out required activities towards addressing the security challenge in the state' (cited in Nimi 2021). Contrary to classical scenarios, the local population welcomed the shutdown. Many endorsed the government's action, viewing it as a tactical move that could help to reduce insecurity in their state. Nimi (2021) cites numerous cases of Zamfara residents who, in spite of their predicament, openly expressed support for the shutdown.

The most recent social media blackout in Nigeria was the Twitter ban that lasted from 4 June 2021 to 13 January 2022. It followed the deletion of an aggressive message posted by President Mohammadu Buhari, Nigeria's head of state, on Twitter three days earlier. Following a growing wave of violent activities speculatively attributed to an Igbo-based separatist group called the Indigenous People of Biafra (IPOB), Buhari posted a series of

aggressive tweets on 1 June 2021. In one of these he threatened to treat Nigerians who misbehaved 'in the language they understand'. Verbatim, the presidential tweet read:

> Many of those misbehaving today are too young to be aware of the destruction and loss of lives that occurred during the Nigerian Civil War. Those of us in the fields for 30 months, who went through the war, will treat them in the language they understand. (cited in Sahara Reporters 2021).

This tweet does not explicitly threaten the IPOB or the Igbo tribe. However, many national and international observers interpreted it as a message with tribalist and even genocidal intent. This interpretation hinged on the tweet's reference to the Nigerian civil war (Sahara Reporters 2021; Auwal 2021). Many suspected that the president was presaging a severe crackdown on Igbos who supported the IPOB and its military wing, the Eastern Security Network (ESN). They believed this was reminiscent of the Nigerian Civil War of 1967 to 1970, in which thousands of Igbos died. Other observers called on Twitter to suspend the president's Twitter account on the basis that the tweet violated Twitter's prohibition of that 'expresses intention of self-harm or suicide' (Anyim 2021).

For its part, Twitter read Buhari's tweet as incendiary, and deleted it. It replaced the tweet with the message, 'This Tweet violated Twitter's policy, learn more'. This move triggered a series of reprisals from the Nigerian government. First, Nigeria's minister of information and culture, Lai Mohammed, accused Twitter of double standards, claiming that it had not acted against other individuals and groups whose tweets also incited violence. The Nigerian government stated that it regarded the removal of the tweet as 'disappointing'. It also lamented Twitter's tolerance of secessionists' tweets containing fake news and harmful information that could jeopardise national security and unity. As Lai Mohammed stated, 'there has been a litany of problems with the social media platform in Nigeria, where misinformation and fake news spread through it have had real world violent consequences' (cited in Anyim 2021: 5). On the basis of these irregularities, the Nigerian government decided to ban Twitter temporarily.

It also ordered mobile telephone networks to block access to Twitter, and warned the Nigerian population against trying to circumvent the ban. As expected, the ban provoked waves of condemnation in various national and international quarters. Many critics, political activists and human rights groups viewed the action as a clear subterfuge aimed at muzzling adversarial voices and free speech in Nigeria. Other critics associated the ban with the role Twitter had played during the #EndSARS protest that had shaken Nigeria few months earlier. Actually, the #EndSARS movement was a nationwide campaign against police brutality. Its adherents mobilized mainly through Twitter. Added to this, Twitter's CEO, Jack Dorsey, encouraged donations to some groups of protesters. According to some analysts, this provoked the anger of the Nigerian government, spurring it to ban Twitter in Nigeria (Auwel 2021).

The ban was lifted on 13 January 2022 after Twitter had undertaken to meet a number of conditions laid down by the Nigerian government. It required Twitter to 'create a legal entity in Nigeria during the first quarter of 2022', and to 'comply with applicable tax obligations on its operations under Nigerian law'. Twitter was also compelled to 'enrol Nigeria in its Partner Support and Law Enforcement Portals', and cooperate with the Nigerian government on regulating its contents and harmful tweets. The statement announcing the lifting of the ban was issued by Nigeria's technology agency, the National Information Technology Development. It stated:

> Twitter has agreed to act with a respectful acknowledgement of Nigerian laws and the national culture and history on which such legislation has been built and work with the FGN and the broader industry to develop Code of Conduct in line with global best practices, applicable in almost all developed countries (cited in Kene-Okafor 2022: 32).

A number of critics have viewed Twitter's return as predicated on tighter government control. For instance, James (2022) notes that some of the demands made by the Nigerian government – notably the enrolment of Nigeria in Twitter's Partner Support and Law Enforcement Portals – provides the Nigerian police with the means to request and retain data about users. Analysts also suspect that government might want to extend such control on Twitter to other social media companies present in Nigeria. If such a scenario happens, freedom on the net will naturally decrease the more and another evidence of authoritarianism will be established.

Examining the morality of recent internet shutdowns in Cameroon and Nigeria

The Cameroonian and Nigerian governments have mainly sought to justify their recourse to Internet shutdowns in terms of the need to check the spread of harmful/fake news, protect national interests, maintain peace and security, and protect national unity, arguing that their countries might otherwise descend into chaos. Taken at face value, these are noble motivations; however, many international observers and human right groups have argued that these are subterfuges, concealing the actual motives of intimidating oppositional voices and promoting authoritarian rule. To them, the 'national security' arguments are either fictive or negligible, and the belief has grown that these justifications are either irrelevant or less important than the need to protect human rights and encourage economic activities. In other words, the protection of human rights and economic development are paramount, and take precedence over the supposed 'security' rationales.

However, this author believes it is unfair to overlook or downplay the national security rationale advanced by African – in this case the Cameroonian and Nigerian – governments for disrupting the Internet. Social media have become platforms for criminal activities and the diffusion of harmful contents that can mislead the masses and undermine fragile African democracies, including Cameroon and Nigeria. For example, the separatist online propaganda in Nigeria and Cameroon is characterised by fake news and incendiary messages that could fuel unrest and even civil wars. Through various Internet-assisted disinformation campaigns, IPOB, for instance, has created the spurious impression that Biafra may become independent within a matter of months. They have also promoted the belief that the separatists are supported by Israel, Russia, the Vatican, the United States and France (Okpi 2020; Africa Check 2020). A similar scenario is observed in respect of the online campaigns of Cameroonian separatist groups and other political activists.

In their study titled 'Understanding social media role in propagating falsehood in conflict situations', Ngange and Moki (2019) show how the online propaganda spread by Cameroonian separatists is characterised by fake and misleading information, and how it has the potential to create chaos in Cameroon. Along the same lines, Noukeu (2020) has conducted a content analysis of news propagated by separatists and pro-separatist bloggers in Cameroon, and demonstrated how disruptive the latter's online activities could be to Cameroon's unity efforts. He particularly observes that the news propagated by Cameroonian separatist bloggers

with regard to the Anglophone crisis in their country comprised 'stories [that] lacked basic elements of reliability and verifiability. As a matter of fact, the news stories hardly contained clear information about the sources, visual cues to corroborate the texts and factual details such as where and when the events covered happened' (pp.30-31). The stories also incited violence and chaos.

Without wanting to judge the pertinence/morality of the separatist orientation of Nigeria's IPOB and Cameroon's secessionist groups, this author believes that the use of fake news and misleading information can be serious enough to warrant Internet censorship. Checking the spread of misleading and seditious information, even with the help of Internet blackouts, could serve national purposes in Cameroon and Nigeria. AS noted earlier, we need to recall that Internet censorship is justifiable when the Internet is used to undermine the freedom of others or to engender public disorder and insecurity in a country (IFLA 2020; IUT 2017).

Thus, the Cameroonian and Nigerian governments' resort to Internet shutdowns, particularly in their fight against separatist movements, should not be viewed as inherently unjustifiable or unwarranted. However, they do require a formal and acceptable legal framework. As argued by Nyokabi et al (2019), most African governments fail to situation their activities in a formal legal framework, thereby providing a basis for legitimacy. As a result, their Internet shutdowns are mostly illegal. The Nigerian and Cameroon governments may have instituted internet shutdowns for noble reasons (the promotion of peace and national security), but the fact that these initiatives have not been situated in formal legal frameworks have lent credence to accusations of authoritarianism. A common argument used by human right groups to denounce Internet shutdowns in Cameroon and Nigeria is that the shutdowns are unconstitutional.

Besides the scenario presented above, there have been situations, particularly in Nigeria, in which Internet blackouts were applauded by the populace as well as endogenous and exogenous critics. For instance, in February 2021, the Nigerian government instituted an Internet shutdown in north western Zamfara to combat a spate of banditry and ransom-seeking kidnappings in the region. According to various sources (notably Nimi 2021), most residents welcomed the initiative, and cooperated with government security services to ensure its success. This bolsters the perspective that Internet shutdowns should not be regarded as inherently unjustified.

Conclusion

This study was triggered by the observation that scholars have tended to view Internet blackouts in African countries in a universally negative light, branding them as violations of human rights and inimical to economic development. However, while undoubtedly extreme and interventionist measures, Internet blackouts are not inherently unjust and universally inappropriate. This follows from the fact that even influential bodies such as the International Telecommunications Union (ITU) recognise the need to show down the Internet in certain situations. Also, governments that have utilised Internet shutdowns tend to advance reasons that are valid in principle. Three such reasons are to protect their sovereignty, counter 'rascality' among telecom operators, and improve national security.

Against this background, this study has examined the morality of Internet shutdowns in Africa, with specific reference to Cameroon and Nigeria. It concludes that the Internet shutdowns in those countries aimed at combating online separatist propaganda and

inflammatory material could be justified if they were situated in legitimate and appropriate legal frameworks. Without this, their actions remain illegal or unconstitutional.

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The current and potential role of blockchain-based technology in managing medical records in Africa

Eric Blanco Niyitunga, PhD
School of Public Management, Governance and Public Policy,
University of Johannesburg
ericn@uj.ac.za

Abstract

Accurate and well-managed medical records play a major role in high-quality health care. They are a valuable asset that allows hospitals to treat patients in an effective and efficient way. They also play an important role in health care governance, providing evidence in court cases between patients and hospitals. However, in Africa, medical records are not given much academic attention. Good record-keeping has been hampered by a poor management, as well as a lack of trained personnel who understand how to record and keep these records. This study is aimed at exploring the utilisation of blockchain technology in improving medial records at African hospitals. The reserach is qualitative, comprising desktop research of secondary material and its analysis. It finds that poor medical records in hospitals contribute to the prevalence of disease in African countries, which results in funds that could be invested in development projects being diverted to health care instead. It also shows that 4IR, specifically blockchain-based technology, could play a significant role in the management of medical records in Africa. It could help staff to capture and maintain more accurate medial records, and ensure their security and longevity. Moreover, it could improve access to medical records for all health practitioners. Patients could also access their records, thus helping them to evaluate and manage their own health.

Keywords: Medical records, medical records management and governance, blockchain-based technology, health care systems

Introduction

Accurate medical records play a major role in effective medical care. They are also a vital source of information for understanding health services, diseases, and disparities in health and health care. They are also vital for redressing health disparities in patient populations. High-quality health care depends on the ongoing documentation of diseases and their treatment, recorded by authorised health care professionals. Good medical health are required for the delivery of high-quality health services, which improves the health of a given population in turn. According to Luthuli and Kalusopa (2017:2), effective medical records play a vital role in good health service delivery, and ultimately in relieving Africa's health burden. Medical records must be accurate and complete, in order to facilitate ongoing diagnoses and to help health care professionals provide patients with the most appropriate treatment. Wll-

maintained medical records help hospital administrations to run smoothly. To summarise, good medical care depends on accurate record-keeping (Abdulazeez 2015).

According to the NHO's Health Care Records Management Steering Committee (2007: 16), record management is the 'systematic and consistent control of all records in which they are held throughout their life cycle'. According to the World Health Report (2000), the health of a nation partially depends on access to medical records. According to the World Health Organization (WHO), health information records and management determine everything from the availability of health services to the quality and effectiveness of professionals. They also determine the financial resources required for a patient to receive health care services. Medical records are also important for governing health care recipients and providers. They play a key role in heal care policy-making and implementation and ultimately the achievement of good health care governance, which contributes to the health of a nation and the wellbeing of its citizens.

Howson, Fineberg, Bloom (1998) note that policy-makers, practitioners and other role players in the global health system rely on medical records when they design policies for treating patients in hospitals and clinics. Effective management of medical records or health information boosts the maintenance and improvement of curative, preventive, rehabilitative and palliative care. Obversely, poor management of medical records have a range of high negative consequences.

A failure to manage medical records results in poor regulatory frameworks in which vital patient data is fragmented in the form of sheets of paper, scanned images, and electronic data, whose inefficiency ultimately drives up costs (Medeiros and Schwierz 2015). High mortality reates in Africa is the result of negligence coupled with poor diagnoses and treatment, often caused by poor record-keeping (Marutha 2011; Katuu 2015; Pyrene 2015; Marutha 2016). In South Africa, despite efforts to equalise health services for all, poor governance and poor management of medical records has hampered health service delivery, and created numerous problems that overwhelm the health care system (Kaseje 2006).

In Kenya, poor record-keeping has widened the gap between the rich and poor in terms of access to health care services, and opened the door to chronic corruption and inflows of counterfeit drugs that worsen patients' conditions (Oketch 2017: 19). Oketch (2017:21) argues that poor medical records are not only a major cause of iatrogenic injuries, but also make it more difficult to conduct a clinical negligence claim or disciplinary inquiry. It is axiomatic in Africa that poor medical record-keeping is evidence of poor clinical practice. It leads to delayed and inappropriate treatment, wastes time, and frustrates both health care providers and recipients (Alegbeleye 2009).

Against this background, this study examines whether digital technologies, and specifically blockchain-based technology, can be utilised to improve medical record-keeping in African settings, thus contributing to improved health care and heal service delivery. This has received insufficient academic attention. According to several analysts, blockchain-based technology could provide a reliable platform for electronic health records (Koushik et al 2019: 985). Blockchain technology is a new type of digital technology that consists of 'a shared, immutable ledger that can better ensure the resilience, provenance, traceability, and management of health data' (Mackey et al 2019: 2), and can 'shape the foundation of a decentralised medicinal service stage shared by the patients and suppliers, acting as an interface to the patient's record' (ibid). It is decentralised, which provides open access to

patients and medical practitioners alike, and can there make a major contribution to improed medical care (Haddad et al 2021).

This study confirms that blockchain-based technology can indeed improve the management of medical health records, thereby addressing major problems plaguing Africa's health care industry. This, in turn, can improve the physical wellbeing of African citizens, a prerequisite for sustainable development.

The aim of this paper is therefore to evaluate the benefits of applying 4IR technologies in the health care industry, with a particular emphasis on exploring and conceptualising the role of blockchain-based technology for managing medical records.

It seeks to answer the following research question: *how can blockchain-based technology be utlised to improve medical record-keeping in Africa, thereby improving health care and the wellbeing of African citizens?* The next section sets out the conceptual framework utilised for this study, and the methods used to collect and analyse data. Next, the data is presented and analysed, following by conclusions and recommendations.

Definition of terms

The first term we need to define is 4IR. It was coined by Klaus Schwab, founder and executive chairman of the World Economic Forum. He described a 'world in which individuals move between digital domains and offline reality, utilising connected technology to enable and manage their lives' (Miller 2015: 3). Velásquez, Estevez and Pesado (2018: 259) note that 4IR is not subject to a singular accepted definition; however, they characterise it as incorporating Information Technology (IT) into Operations Technology (OT) in a way that 'allows communication between machines and the use of customers' data in the production process to enable the customisation of products'. Zezulka et al (2016: 8) further state that 4IR serves three interconnected purposes, namely: (i) the digitisation and integration of any economical complex networks; (ii) the digitisation of products and services, and (iii) new market models, adding: 'These human activities are interconnected by communication systems.'

The first industrial revolution involved the transformation of an agrarian and handicraft economy into one dominated by industry and machine manufacturing In the second, mas producdtion was aided by the discovery of oil and electricity. The third industrial revolution involved the introduction of information technology (IT), used inter alia to automate production (Xu, David & Kim 2018: 90). While each industrial revolution is frequently regarded as a separate event, they can be better understood as a series of events that built on the innovations of the previous revolution and led to more advanced forms of production.

This means that numerous parallels exist between four industrial revolutions and the five ages of civilisation: the hunter-gatherer age, the agricultural age, the industrial age, the information worker age, and the emerging age of wisdom (ibid: 91). Covey (2011: 11-17) argues that 'the characteristics of these five ages of civilisation can be used to infer the opportunities of the 4IR'. Every industrial revolution has had ramifications for and negative impacts on the world at large. It has been argued that the productivity of each succeeding age increases 50 times over the preceding age, with the most notable increase from the articultural to the industrial age (Xu, David & Kim 2018: 91). Furthermore, each succeeding age eliminates many of the jobs created by the preceding age; for example, the information age is replacing the jobs created by the industrial age (ibid). The numerous job losses occasioned by the advent of 4IR

have almost nothing to do with government policy or free trade agreements, and everything to do with the dramatic shift to the 'knowledge worker' (ibid). Thus the 4IR has resulted in very significant changes and is transforming entire production, management and governance systems (Schwab 2015).

Medical records

Luthuli and Kalusopa (2017:4) define medical records as written accounts of a patients' examination and treatment that include the patients' medical history and complaints; the physicians' findings; and the results of diagnostic tests, procedures, medications and therapeutic procedures. The International Records Management Trust (IRTM) defines them as 'patient records' (1999: 10), and Haux (2006: 272) as a 'confidential record kept by a health care professional or organisation for each patient Medical records include 'personal information about the patient (such as name, address, and date of birth), a summary of the patient's medical history, and documentation of each event, including symptoms, diagnosis, treatment, and outcome' (ibid). Furthermore, Huffman (2001) defines medical records as 'any records that document the pertinent facts of a patient's life and health history, including past and present illness (es) and treatment(s), as written down by the health professionals handling the patient's care'.

Medical record management

The IRMT (2009) defines record management as the task of ensuring that all recorded information, regardless of form and medium, is managed in an economical and efficient manner. Zali et al (2018: 1) note that medical record management provides 'evidence of activities or business transactions'. This means that the purpose of medical records is to record past diagnoses and treatments, thereby easing the task of future medical care practitioners. They further submit that good health record management provides a foundation for making informed health care decisions and good health care policies, based on a solid foundation of knowledge. According to the IRMT (1999: 12), good health record management is necessary for the delivery of high-quality health services and the achievement of high levels of performance in hospitals and agencies.

Blockchain-based technology

According to Sadiku, Kelechi and Sarhan (2018), blockchain-based technology consists of a shared or distributed database used to keep track of a growing list of transactions known as blocks. The term 'blockchain' refers to the way in which transaction data is stored in blocks that are linked together to form a chain (Sadiku, Kelechi and Sarhan 2018: 155). This is often referred to as the 'chain of trust'. When applied to governance, blockchain technology has the potential to increase trust, accountability, openness, participation and transparency. In the business world, it is used to aid transactdions and streamline business processes (ibid). Satoshi Nakamoto created this technology in 2008 as the foundation for the exchange of the digital cryptocurrency popularly known as Bitcoin. The technology serves as the foundation for cryptocurrencies such as Bitcoin, Litecoin, and Ethereum (ibid).

Blockchain has largely been utlised in the financial industry, allowing Bitcoin to operate, among others (Tsai et al 2017: 452; Iansiti and Lakhani 2017). Today, blockchain technology is used in a variety of industries, including health care, insurance, pharmaceuticals, manufacturing, e-voting, legal contracts, tourism, energy, and travel (Engelhardt 2017; Manski 2017: 514). For example, blockchain-based technology can be used to improve patient care, financial

transactions, drug distribution, and medical record management and governance. According to Manski (2017: 513), blockchain technology allows patients and caregivers to securely share patient identity and health care information across platforms. Therefore, it allows patients to envision a future in which they hold the keys to their own health care (ibid: 514).

Methodology

This is a qualitative study based on secondary research, namely desktop research and analysis. This method is best suited to health studies due to its emphasis on people's lived experiences (Al-Busaidi 2008). According to Miles and Huberman (1994), it is well suited for locating the living meanings that people place on events, processes and structures, as well as their perceptions, presuppositions and assumptions. Denzin (2005) and Creswell (2007) state that when applied to health research, the qualitative method has the advantage of being based on a systematisation of knowledge which allows it to provide a sense of order and orientation. Furthermore, it allows a better understanding of diverse data sources, and an identification of information relevant to the study (Katurura and Cilliers 2017; Boell and Cecez-Kecmanovic 2014).

Data was gathered by means of desktop research, specifically about medical records, health care, 4IR, and blockchain technology. Reports in various African countries were studied to identify their specific challenges and issues in resapect of medical record-keeping. Document analysis is commonly used in health policy research. Weber (2015) argues that written documents are essential components of the bureaucracies that enable modern societies to function, including in public health. Document analysis allows one to describe the content or categorise approaches to specific health problems in existing policies (Adebiyi et al 2019). For example, this method has aided the understanding of South African health policy responses to foetal alcohol spectrum disorder (Katchmarchi et al 2018; Adebiyi et al 2019). This is due to the fact that document analysis is a methodical process for reviewing or evaluating documents that can be used to provide context, generate questions, supplement other types of research data, track hangeover time, and corroborate other sources (Bowen 2009).

Literature review

Health is wealth, and hospitals play a key role in underpinning the health of citizens. Yeo (1999) notes that hospitals are those institutions that deal with the life and health of patients. A good medical care system is dependent on well-trained doctors and nurses, as well as high-quality facilities and equipment. Hospitals are concerned with their patients' lives and health. Medical personnel may not provide the best treatment or may misdiagnose a condition if accurate, comprehensive, up-to-date and accessible medical records are not available (Garba 2016). Associated records such as X-rays, specimens, drug records, and patient registers must also be well managed (Luthuli and Kalusopa 2017: 3). The management of medical records play a major role in the efficacy of hospital governance and administration. Ultimately, good record-keeping saves time as well as lives. Garba (2016) notes that good record-keeping includes the transfer and/or destruction of all unnecessary records, thereby saving time and resources. Managing and maintaining medical records further demonstrates a hospital's accountability (Yeo 1999). They serve as an important source of information for medical research, statistical reports, and health information systems (Yeo 1999).

Huffman (2001) asserts that medical records are the who, what, why, where, when and how of patient care during hospitalisation'. They serve as records of the entire history of patients

in hospitals, as well as measurements of the work of doctors and nursing staff. They also track patients' progress, the nature of diseases, and serve as data sources for researchers in the pharmaceutical industry (Garba 2016). Dikopoulou and Mihiotis (2012) note that medical records are at the centre of the daily operations of hospitals. Population growth, an increase in the number of patients, and the emergence of new diseases all necessitate health care organisations able to capture and manage massive amounts of information (Desouza 2005). Medical records are an essential component of any medical practice, because they help to ensure good patient care and may also play an essential role in any future dispute or investigation (Dikopoulou and Mihiotis 2012).

Medicalrecords include relevant documents and correspondence between patients and health professionals. They contain vital information for monitoring patient care, conducting clinical audits, and assessing patterns of care and service delivery (Houston 2008). Furthermore, medical health records are vital because they connect the information chain that generates depersonalised, aggregated and coded data for statistical purposes (Houston 2008). Furthermore, Adeleke (2014) argues that, in addition to providing patient information, medical records also play a vital role in medical schools, the training of other health professionals, and in pharmaceutical firms. To this end, Garba (2016) confirms that medical records must be properly compiled and kept up to date. They contain sufficient data to allow health professionals to identify patients, support diagnoses, and justify the treatments administered to patients. Medical records are the visible and audible evidence of health professionals' activities, achievements and accomplishments in hospitals and clinics.

Likewise, Haux (2006) asserts that medical records provide information about patients' health that allows for the accurate identification of the patient. They are an invaluable tool within hospitals and the communities in which they operate, exemplifying good health service delivery (Hajavi, Ebadi and Meidani 2005). Medical records can also be used to support a diagnosis based on a patient's history, physical examination and investigations (Haux 2006). This means that proper medical record-keeping ensures patients' continuity of care. They also help to justify the activities of health care workers in relation to specific patients. Ball (2003: 83) affirms that 'medical health records are aide memoires for health professionals treating patients, and serve as essential components of patient care'. Medical records play a significant role in the treatment of disease because they contain information about the patient, as well as the physicians' opinions and clinical judgment.

According to Huffman (2001), medical records include or should include the following:

- Doctors' clinical notes;
- Recordings of discussions with patient /next of kin about disease/management (with witness);
- Referral notes to other specialist(s) for consultation/co-management;
- Laboratory and histopathological reports;
- Imaging records and reports;
- Clinical photographs;
- Drug prescriptions;
- Nurses' reports;
- Consent forms and At-Own-Risk discharge forms;

- Operation notes and anaesthetic notes;
- Video recordings;
- Printouts from monitoring equipment;
- Letters to and from other health professionals ;
- Computerised/electronic records; and
- Recordings of telephone consultations/instructions relevant to the care of the patient.

In addition, Durking (2006) states that medical health records contain, or could contain, items such as:

- Patient history and examination reports;
- Consultation reports;
- Operative reports;
- Radiology reports;
- Pathology reports;
- Laboratory reports;
- Emergency reports;
- Subjective, Objective, Assessment & Plan notes;
- Progress note reports;
- Therapy reports;
- Clinical notes;
- Autopsy reports;
- Biopsy reports;
- Psychiatric observations;
- X-ray reports;
- Scan reports;
- Referral letters; and
- Daily reports.

The significance of medical records

A medical record is a primary tool in the practice of medicine, patient treatment, and disease prevention. It provides adequate and better health care to patients by maintaining meticulous records about the their medical conditions (Huffman 2001). Polit, Beck and Hungler (2001) note that a medical record facilitates communication between the patient and health professionals by detailing the patient's progress. It also acts as a communication link between the patient's caregivers (Huffman 2001). Furthermore, for those health professionals who provide health services on subsequent occasions, the medical record provides a history of illnesses and treatment provided, allowing them to critically assess the patient's status. It can be argued that without proper medical records, satisfactory treatment cannot be achieved, and good health in Africa will remain a pipe dream.

Berg (2001) emphasises that medical records are vital tools for communicating a patient's progress. To that end, medical records provide valuable information about disease epidemiology, which is vital for a country's health system and, by extension, a nation's health (Berg 2001). Medical records enable hospital staff to assess the quality and quantity of the services provided. They are invaluable to hospitals for medical legal purposes; if properly written, kept and maintained, they serve as the hospital's or practitioners' primary defence and advocate in any official proceeding (ibid). Medical records are also essential during the teaching and training process (Adeleke 2014; Szajna 1996; Terry 2005). This means that medical records are used to ensure the continuity of patient care throughout the patient's life, monitor and evaluate the patient's progress, to compile health statistics, and conduct research and education in medical schools and institutes.

Medical records are an important source of evidence in hospitals, and are supposed to be kept and preserved as evidence of business transactions (Zali et al 2018: 233). It is argued that when preparing medical health records, health professionals must keep in mind that they are creating documents that reflect his personal findings and disease management (Mayo Foundation for Medical Education and Research 2014). These records may be required by the patient and courts during litigation proceedings (Malaysian Medical Council 2006). Furthermore, medical records must be kept in secure rooms to ensure that they are well secured even when not in use (Zali et al 2018: 233). They should be protected from any harmful threats such as vermin and adverse weather, and should be easy to access when needed. They should also be returned in complete and undamaged form after use (ibid).

Mampe (2013) and Luthuli (2017) argue that medical records support accountability, security, integrity and comprehensiveness, and are vital to effective health service delivery. According to the IRMT (1999: 1), if medical health records are not properly managed, health services will suffer and good health will not be achieved. Good medical care is dependent on well-trained doctors and nurses as well as proper health record-keeping (ibid). The provision of the best medical treatment and disease diagnosis is largely based on the patient's comprehensive, up-to-date and accessible medical records (ibid: 2). Furthermore, easy access to records will ensure consistent service delivery (Dunlay et al 2008).

Poor record management endangers patients' health and has a negative impact on treatment and medical diagnosis. According to Asunmo and Yaya (2016: 2), 'poor medical health records tend to affect patient care adversely because clinical treatment of patients is dependent on case histories contained in their medical files'. Poor medical record-keeping practices across Africa have exacerbated illnesses and hampered efforts to achieve good health and the well-being of citizens. The literature reveals that similar issues arise as a result of poor medical record-keeping across the African continent. For example, in Zimbabwe, Chikuni (2006) argues that the lack of effective medical record-keeping has significantly affected health service delivery. Chikuni also claims that the lack of medical records to guide decision-making has made it difficult for medical practitioners to provide good health services in Zimbabwe (ibid). Mayanja (2005: 11) reports that hospital staff in Uganda appeared unconcerned about the importance of medical records in patient treatment and follow-up.

In Ghana, existing record-keeping systems at some public hospitals are not designed to collect information on some diseases, leading to poor monitoring, supervision and decision-making (Adjei 2000:5). According to Wong and Bradley (2009:3), a researcher at a rural hospital in Ethiopia described a similar challenge in which patient registration numbers were duplicated, records were lost and patients were assigned new registration numbers, clinical information was recorded on loose scraps of paper, and medical records were poorly archived. In South

Africa, the Western Cape Government's Desai Commission reported that poor medical records management hampered service delivery (Ngoepe 2004). According to Luthuli and Kalusopa (2017:4), unpaid patient bills amounting to millions of rands from 1994 to 1999 had to be written off due to incomplete patient records in North West and Gauteng provinces.

Some scholars have argued that poor medical record-keepiong is a major cause of poor health service delivery in South Africa (Khoza 2008; Marutha 2011; Katuu 2015; Pyrene 2015; Marutha 2016). Moreover, poor health and ill health are the consequences of failing to properly manage and keep medical health records (Zali et al 2018: 233). Due to a lack of funding, hospitals in Africa may well lack the equipment and resourcers needed to capture and maintain medical records. The Mayo Foundation for Medical Education and Research (2014) reports that many hospitals are edperiencing problems with paper-based records.

Challenges affecting medical records in africa

The management of medical records have remained a challenge for many African hospitals, generating a slew of concerns over time. One of the challenges is that many African health practitioners and governments have failed to recognise the link between medical records and good health. Larsen and Marstein (2000) assert that training record managers and improving the record-keeping methods and systems will ultimately improve health care in African countries. It has also been argued that adequate medical health records allow health practitioners to reconstruct the essential components of each patient contact without reliance on memory, which may prove increasingly unreliable and deficient over time (Medical Protection Society 2016).

The failure to record and maintain proper medical health records on a regular and efficient basis is another challenge. Patients' records are not available in many African hospitals; this detrats from their treatment, and complicates the possibility of fighting diseases and achieving good health. According to the Medical Protection Society (2016), taking down medical records on a regular basis is difficult in Africa. According to a report by the Medical Protection Society, good quality medical records taken on a regular basis by trained experts are an essential component of safe and effective healthcare (ibid). It is submitted that keeping proper medical records and updating them on a regular basis facilitates health care continuity and the provision of quality care, which leads to good health and promoters human well-being.

Another barrier to achieving good health in Africa is a lack of trained and experienced personnel. According to Davenport (2005), record-keepoing staff should consist of workers who have expertise, knowledge, training and experience in medical record-keeping. They must be people who understand the effects of medical record-keeping on patients and societal health (ibid). Preserving and conserving medical records in African hospitals has remained one of the most difficult challenges, contributing to increased mortality rates and disease. Hospitals and governments have not invested adequately in training and educating hospital record-keepers. Adeyemi (2012) notes that this challenge has become prominent because record preservation is not at the centre of most medical science curricula, and thus inadequate technical expertise in medical records prevails.

Another issue is the poor storage of inactive records. Also, many African hospitals still use outdated forms. Besser (1999) notes that medical records kept in out-of-date formatd do not last as long because they become brittle and deteriorate quickly. They may also be damaged

by dust and dirt on storage surfaces, as well as various types of insects. They may be damaged by fungi and stained by water, oil, ink, or simply dirt.

The safety and security of medical records is also a concern, and personnel in charge of patient records are at risk of losing those records. In Africa, many hospitals are maintaining manual records on outdated forms, resulting in storage issues. Medical records on outdated forms do not meet accepted standards of data safety and security. Unsecured medical records pose a hazard to both patients and society, and endanger doctors and nurses as well as hospitals.

The role of blockchain technology

Mackey et al (2018: 68) show that blockchain technology is being used and can be used to improve businesses in the health care sector, patient outcomes, and medical records. This technology is improving compliance, lowering hospital bills and costs, and enabling better use of health care-related data (ibid). Blockchain technolgoy has proven to be a reliable platform for improving and ensuring the security of health records. It serves as an effective conduit between patients and suppliers, and an interface with patients' records. According to Alhadhrami et al (2017), blockchain-based technology can be permissioned or permissionless. Both are useful in health care and in overcoming the challenges associated with managing medical records.

Ensuring the safety and security of medical records

Blockchain-based health care systems can help to address the issues and problems related to data security, privacy, sharing and storage (Azaria 2016; Engelhardt 2017:25). It will enable the establishment of easily accessible central records, which will work to imrove the quality of health services. Centralised systems are valuable because they secure medical records and make them easily accessible (Green 2011: 10). As a result, time is saved and patients are treated more efficiently. Blockchain-based technology in health care ensures the security of medical records, management, and patient privacy.

Wang et al (2020) add that blockchain-based technology ensures data integrity and incorruptibility, and protects medical data from being tampered with or stolen. It is a distributed database that ensures data storage in each network while also providing increased stability, reliability, security, consistency and attack resistance, as well as speeding up medical data exchange (ibid). Blockchain-based technology also decentralises medical records, returning ownership to patients and allowing them to govern and manage their records in order to monitor and take good care of their own health.

Yang and Yang (2017: 6) and Xia et al (2017) state that the use of blockchain technology results in a MedRec system that 'ensures the security of medical health records MedShare system that provides data provenance and control in cloud repositories among hospitals'. Liang et al (2017), for example, used the Hyperledger fabric membership service and channel formation scheme to guarantee data privacy in a blockchain network for medical data-sharing. According to Hasavari et al (2019), blockchain-based technology is a solution for recording patients' emergency medical data, and allows ambulance crews and/or paramedics to use it for urgent, high-quality pre-hospital care.

Azaria (2016) submits that blockchain-based technology ensures data integrity in the blockchain networks. It uses the Ethereum-based blockchain to govern medical health records

and ensure their security (Nchinda and Cameron 2019). Kamel, Wilson and Clauson (2018: 25) explain that 'blockchain data is secured through cryptography so that participants can trust that blocks of data are authenticated and verifiable'. Other scholars have stated that blockchains in health care act as a 'digital backbone for other technologies such as cloud computing, artificial intelligence, eHealth and mHealth devices/applications, and the broader Internet of Medical Things' (Griggs et al 2018: 130; Brogan et al 2018: 259). A blockchain can keep an immutable record of every time a data record is accessed or modified. Governments and hospitals can use Keyless Signature Infrastructure (KSI), a blockchain-based technology, to protect government data and electronic health records from external cyber-attacks and internal misuse (Dubovitskaya 2019). The KSI blockchain technology application provides security while respecting the privacy of medical health data (ibid).

Ensuring the transparency of medical records

The use of blockchain-based technology in health care management improves the transparency and clarity of data access among practitioners, medical specialists, hospitals, and therapists. This saves time and resources, improves the medical information process among various medical stakeholders, and reduces incidents of medical negligence. Because the history of previous medical consultations with physicians is not tampered with, this fosters trust and confidence, and promotes efficient medical treatment (Koushik et al 2019)

Azaria et al (2016: 25-30) state that blockchain technology manages authentication, confidentiality, accountability, and data-sharing. It also enables patient data-sharing, and provides incentives for medical researchers to sustain the system (Azaria et al 2016: 30). Because blockchain-based technology allows patients to access an encryption key that allows health practitioners to access their personal health data, it enables a transparent and auditable system (Sadiku et al 2018). According to the OECD report mentioned previously (2020: 7), it gives health practitioners, service providers and health researchers access to patients' medical health records, and allows them to access other medical information for the purposes of direct health care delivery, as well as to allow for research, statistical, or other uses of patients' health data.

Ensuring sound management of medical records

The poor governance and management of medical records has impacted on the quality and nature of health services, resulting in high mortality rates in Africa. Blockchain-based technology can assist in the governance and management of medical health records, providing patients and health practitioners with centralised access to their entire medical history across all providers. Because it can expedite patient health records, blockchain-based technology promotes and improves medical record governance. It allows medical records to be more effective, disintermediated, secure and interoperable. Health practitioners can use blockchain-based technology to sync all of their patients' medical records in real time. It also allows them to have a complete medical history of the patient, and grants access to anyone who may require the patient's records (Alhadhrami et al 2017).

Protecting drug development and distribution

Blockchain-based technology enables drug developers and manufacturers to run clinical trials and share medical samples in a secure environment (Eze and Musa 2018: 156). The use of blockchain-based technology in health care makes clinical trials more reliable by tracking and time-stamping at each stage of the trial, thereby reducing waste. It also

increases accountability and transparency in clinical trial reporting (ibid: 158). In addition, it unifies disparate health care processes, improves regulatory compliance, improves patient experience, lowers health care costs, and provides autonomous monitoring and thje preventive maintenance of medical devices.

It also reduces the time it takes for new drugs to reach the market (Mettler 2016), and has the potential to transform health care systems by putting the patient at the centre of the health care ecosystem (Alhadhrami et al 2017). It also increases patients' trust and confidence when purchasing drugs for treatment, thereby addressing problems in pharmaceutical supply chains. These issues include intellectual property protection, quality control, counterfeiting, and illegal drug sales (Mettler 2016). According to MediLedger (2020), blockchain-based technology is proving to be an effective technology for verifying the authenticity of suppliers and purchasers due to the immutability of its records.

For example, in the Hyperledger's Counterfeit Medicines Project, products are time-stamped and entered on a blockchain for tracking and verification (Taylor 2016). Moreover, blockchain-based technology ensures efficient and adequate supply while avoiding drug shortages, which have been a major issue in the health care industry. For example, Ting (2020) argues that Chinese hospitals used blockchain-based technology to ensure the accurate tracking and timely delivery of medication to Covid-19 patients' homes. In Uganda, blockchain-based technology was also used to combat counterfeit drugs, which lead to 250 000 malaria and pneumonia deaths among children each year (Rahman 2019). According to Ndemo et al (2019), blockchain technology has increased transparency, accountability, and efficiency in drug development. Blockchain-based technology provides patients with confidence and trust when purchasing drugs from medical pharmacies that use a scanned QR code. Blockchain-based technology also aids in identifying the true source of medical drugs and ensuring that suspicious and counterfeit drugs do not enter the distribution chain.

Conclusion

This study has assessed the current and potential role of 4IR in the governance of medical records in Africa, with a particular emphasis on the positive influence of blockchain-based technology. It began with a conceptual analysis of both health and 4IR literature, which aided in understanding the challenges of medical health record-keeping, as well as their role in delivering quality and effective health services. It found that poor medical record-keeping continues to jeopardise the delivery of health services in Africa, which undermines human wellbeing and sustainable development in turn Despite this, medical recordkeeping in Africa has received little academic attention.

A good record-keeping system is required for the delivery of health services that lead to good health and disease relief. Blockchain-based technology has begun to play a positive significant role in the African health care sector, and has the potential to play far greater role in the future. It enables the effective management of medical records and their availabity to health practitioners in hospitals as well as patients, allowing better and faster treatments, and saving lives. Patients are able to access their medical records, making it easier for them to evaluate and manage their own health. Blockchain-based health technology protects and secures medical records. It aids in combating financial fraud and counterfeit drugs, which plague the health care industry and impede the delivery of effective medical treatment.

Given this, governments in Africa and other stakeholders should allocate more funds for the training of staff who maintain medical records, and African universities should offer dedicated courses to this effect as well. Policy-makers and planners should ensure they understand the interconnections between good medical records, effective health services, and good health. Blockchain-based technology can play a major role in resolving the problems confronting the health care industry, and thereby promoting the health and ultimately the wellbeing of Africa's people.

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The potential of increased internet penetration to combat corruption in Africa

Marcus Hollington
Demography and Population Studies,
School of Public Health and Social Sciences,
University of the Witwarsrand
hollington.marcus@gmail.com

Abstract

This paper /study examines the relationship between internet penetration and perceptions of corruption in African countries. In particular, it assesses the potential of the former to address the latter, which has crippled economic growth and development for decades. The way in which corruption has seeped into the continent's responses to the Covid-19 pandemic underscores that combating corruption is more urgent than ever before. Utilising correlation analysis, this study finds that there is a positive correlation between IP and perceptions of corruption. It concludes with recommendations for combating corruption in Africa and its regressive effects on the continent's socio-economic development.

Key words: Covid-19, internet penetration, corruption, e-governance, ICTs.

Introduction

The 2019 novel coronavirus pandemic has exposed the problems and inadequacies in Africa's health sector, among others by highlighting disparities in government responses as well as poor capacity (notably for testing and hospitalisation) in the sector itself. It has also highlighted the continued economic vulnerability of the poor, reminding us that an estimated 85% of the continent's populace live on less than $5,50 a day (Aguilar et al, 2010). This unsettling figure is the result of decades of economic stagnation, caused, among others, by endemic corruption. Corruption undermines development in multiple ways – among others, by bleeding off government resources, reducing the efficacy of government expenditure, and discouraging local and foreign direct investment. It also saps the political will of politicians, demoralises or corrupts civil servants, and undermines citizens' trust in government as well as their hopes for holding their governments acountable. Ultimately, it challenges citizens' rights to accountablity, and works to undermine their rights to freedom of expression and political mobilisation (Mustaka, 2020).

Corruption also encourages authoritarian government, and encourages governments to suppress political opposition and the free flow of information. As evidenced by numerous internet shutdowns around the globe, corrupt governments fight to curb the free flow of information, for fear of provoking popular protests as well as international condemnation, possibly resulting in the withdrawal of foreign aid and damaging economic sanctions.

As elsewhere, African governments have responded to the Covid-19 pandemic by imposing social shutdowns, with severe consequences for economic activity. Due to corruption, among other factors, African economies are far more fragile than those in countries with more accountable governments and healthier economies, and therefore far less able to withstand the disruptions caused by the shutdowns.

This article assesses the responses of African governments to the pandemic, ostensibly aimed at protecting the wellbeing of their citizens. It argues that the widepread inability of African governments to test and treat citizens and roll out effective economic stimulus packages has been corroded by decades of corruption. It does this by examining the role of internet penetration (IP) in citizen's perceptions of public sector corruption. It also assesses the role of social media in exposing corruption to citizens and the rest of the world. It concludes by discussing how – in the form of e-governance -- the fourth industrial revolution can be leveraged to achieve more transparent and accountable government, and therefore to combat corruption.

Background

The first case of Covid-19 in Africa was identified in Egypt on 14 February 2020 (Africa CDC, 2020). Like most countries elsewhere, African governments responded by imposing national lockdowns of varying severity. On 3 March 2020, Morocco became the first African country to restrict citizens' movements, followed by the Democratic Republic of Congo on 18 March, Liberia and Burkina Faso on 21 March, and South Africa and Ethiopia on 26 March (Our World in Data, 2020).

Africans soon began to suffer the adverse effects of the pandemic and lockdowns, notably hunger due to a loss of economic activity. Given that 85% of Africans are 'self-employed' as street vendors and day labourers, among others, they have no job security, and many were severely affected by the lockdowns (Deutsche, 2020). In 2020, the UN calculated that the pandemic could result in 30 million more people joining the ranks of the poor. Moreover, disruptions of food aid supply chains were expected to affect about 50 million more people in the Sahel region alone. Locust plagues in East and some parts of southern Africa pose ongoing threats to food security (International Rescue Committee, 2020).

Additionally, millions of Africans live in informal settlements, with as many as 10 people sharing single shacks or shelters. As a result, social distancing was difficult or impossible to implement, thus leading to higher levels of infection. Poor testing capacities made it more difficult to detect and combat the spread of the virus in these high-density areas (Deutsche, 2020). As a result, African governments appealed for international assistance in the form of financial aid and protective equipment.

However, government officials soon began to divert government and donor resources for personal gain (Schipani, Cotteril, and Mushi, 2020). In Zimbabwe, the journalist Hopewell Chinono was arrested for exposing Covid-related corruption, sparking public protests against the ZANU-PF regime. However, planned protests were called off due to fears of brutal police and military repression, ordered by the president. The Zimbabwean government also shut down the internet to limit the spread of information.

This became a trend among corrupt and authoritarian African govenments, with Burundi employing the same tactics during its elections in July 2020. In Kenya, the misuse and

misappropriation of Covid-19 aid by public sector officials also provoked public protests (Schipani, Cotteril, and Mushi, 2020; BBC, 2020).

Uganda's ambassador to Denmark, Nimisha Madhvani, was recalled for plotting to divert financial resources allocated to combating the pandemic while four health officials in Somalia were arrested for misappropriating COVID-19 relief funds (Schipani, Cotteril, and Mushi, 2020; Yusuf, 2020). In South Africa, government officials and even cabinet ministers – all members of the ruling ANC – were also accused of large-scale corruption in respect of contracts for the procurement of medical equipment and protective clothing (Schipani, Cotteril, and Mushi, 2020). Allegations about the misappropriation or misuse of relief funds emerged all over the continent, with governments conducting internal investigations to ascertain whether public officials were siphoning off public funds. In just one example, it was found that corrupt health officials in Nigeria had hiked the price of face masks to $53 apiece (Schipani, Cotteril, and Mushi, 2020). The widespread misappropriation of relief funds served to undermine the confidence of the international community and indeed African citizens in the ability of African governments to utilise resources for combating the pandemic in a transparent and efffective way. It has discouraged domestic and international investment, and further undermined the quality of governance and public service provision, ultimately continuing to inhibit economic growth and development (The African Capacity Building Foundation, 2018: 1; Nduku, 2015). Ultimately, corruption also perpetuates the hold on political power by small governing elites, who enrich themselves at the expense of the masses.

Sources and methods

As noted previously, this study seeks to correlate IP with perceptions of corruption, as a means of assessing whether improved IP could be utilised to combat corruption. To this end, it utilised IP and Facebook subscription data as of March 2020 from Internet World Stats, and corruption perception data from Transparency International. A 1-tailed Pearson correlation test was used to calculate the nature and strength of the relationship between IP, which constitutes the independent variable (IV) for the first segment of the analysis, and the Corruption Perception Index (CPI) and Facebook subscriptions, whiel constitute the dependent variables (DV). The formula used to conduct the Pearson correlation test is as follows:

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}} \qquad (1)$$

Where r_{xy} = *Pearson r correlation between x and y*
Where n = *numbers of observations*
Where x_y = *value of x (for ith observation)*
Where y_i = *value of y (for ith observation)*

The scale of the correlation co-efficient ranges from −1 (perfect negative downhill linear relationship) to 1 (perfect positive uphill linear relationship), where 0 indicates that there is no linear relationship. In addition, the study conducted a regression analysis to determine the effect that the IV has on the DV and to assess the variation, computed with the formula below:

$$\Upsilon = a + bX \qquad (2)$$

Where $Y = DV$
Where $X = IV$
Where $b = slope$
Where $a = y\text{-}intercept$

Hypotheses

The study hypothesises that citizens of countries with low levels of IP are less likely to perceive their govenrments as corrupt due to a lack of information and possibilities of social interation provided by social media.

Limitations

To remain relevant, the data may need to be updated.

Results

Table 1 shows the regression slope, Pearson correlation and determination coefficients between IP (% of the population), CPI, and Facebook subscription in Africa, based on Internet World Stats as of March 2020 and the CPI from Transparency International as of 2019 (Internet World Stats, 2020). It shows that the regression slope and the correlation coefficients for IP (which constitutes as our IV) and CPI and Facebook subscriptions (which constitute as our DVs) are both positive. The regression slope for these variables are 0,23 and 0,53 respectively, while the correlation coefficients for CPI and Facebook subscriptions are a moderate 0,42 and a relatively strong 0,63 respectively. These results were generated using observations from 55 African countries. The determination coefficients (R^2) for these variables as produced by the regressionf analysis were 18% and 40%.

Table 1: Regression slope, pearson correlation and determination coefficients

Regression slope Internet penetration to	Correl test Internet penetration to	Number of observations	R^2
Corruption Perception Index			
0.23	0.42	55	0.18
Facebook subscriptions			
0.53	0.63	55	0.40

Source: compiled by the author.

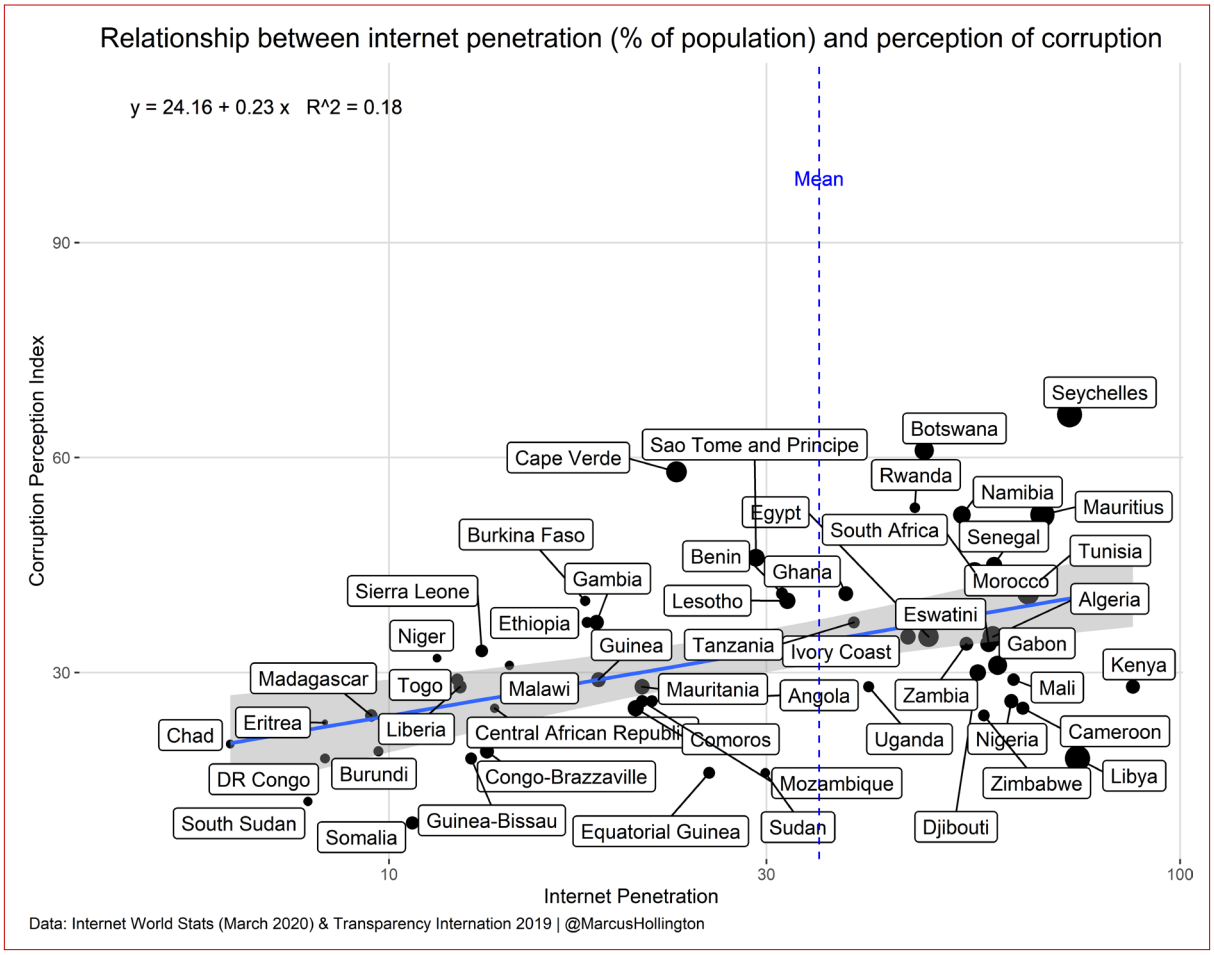
Figure 1 is an extension and visual illustration of Table 1, and delves deeper into the study's regression analysis. It shows that the mean for IP in Africa is 34,97%. The size of the bubble represents the percentage of a country's population with Facebook subscriptions. These were considered as an intervening variable due to its pivotal role in exposing corruption. However, its efficiency as a 'watchdog' mechanism depends on a country's IP. Therefore, Figure 1 goes on to show the relationship between IP and perceptions of corruption, quantified in CPI.

It also shows that the estimated regression line equation for the analysis is:

$$CPI = 24{,}16 + 0{,}23\ (IP)$$

This indicates that 24,16 is the average CPI for a country with an IP of zero. The slope estimate for IP is 0,23, which means that for an average increase for 1 CPI unit, we would expect IP to increase by 0,23 percentage points/units. Lastly, Figure 1 shows that the R^2 for this segment of analysis is 0,18, which means that even though IP accounts for a significant amount of variation in the CPI of African countries, the analysis only explains 18% of the relationship based on the variation in IP.

Figure 1: Relationship between Internet penetration (% of population) and perceptions of corruption



Source: Compiled by the author from Internet World Stats, March 2020; Transparency International, 2019.

Analysis and recommendations

Corruption has been identified as a major hindrance to economic growth and development which is endemic in Africa and elsewhere in the Global South. While not confined to this region, chronic poverty and conflict in most African countries can be partly attributed to corruption.[17] This is because corruption undermines governance, corrodes governments' ability to render services to their citizens, and discourages investment. This has a range of knock-on effects, including weakening tax collection, decreasing international competitiveness, inviting sanctions, losing support from multilateral financial institutions such as the World Bank and the International Monetary Fund (IMF) and undermining currency stability.

Clearly, combating corruption is vital for breaking this vicious cycle of poor governance and underdevelopment, finally opening the way to improving the wellbeing of Africa's citizens. This could be achieved by expanding access to the internet. This is because increased IP will improve the flow of information and the ability of citizens to mobilise, thereby their ability to demand better and more accountable government.

The ability of the internet to expose and curb corruption and human rights violations has been demonstrated the advent of social movements such as 'Black Lives Matter', which inspired the international 'Zimbabwean Lives Matter' hashtag campaign. This, in turn, ahs been utilised to focus international attention on the misconduct of the Zimbabwean government under president Emmerson Mnangagwa.

Given the ability of social media to publicise issues and mobilise people on a global basis, the campaign has gained considerable global traction. This underlines that social movements in a particular period are shaped by the technology available to them. In 1965, television news crews penetrated police blockades and exposed the brutal treatment of civil rights marchers by police to 48 million Americans.[15] In 2020, the internet and social media became a driving mechanism for combating corruption on a global basis.

The potential role of the fourth industrial revolution

It has become clear that the fourth industrial revolution can be leveraged to combat corruption. More specifically, e-governance can be used to enhance transparent and accountable governance as well as citizen participation, and improve service provision.

E-governance can combat corruption by enabling public insight into government tenders and other transactions,[16] providing universal access to tender procedures and other relevant information, and limiting or eliminating personal contacts between government officials and potential contractors.

However, this can only happen if IP is improved. Table 1 shows clearly that IP and perceptions of corruption are highly correlated at 42%. Moreover, the efficiency of e-governance in combating corruption has been demonstrated in both developed and developing countries, although to varying degrees.

Japan, Bangladesh, Israel and Singapore have succeeded in utilising e-governance to improve governance and curb corruption.[18] Kenya, South Africa and Nigeria have taken steps in this direction, but still have far to go.[19] In Africa, e-governance should be enabled by ICT rollouts at a national and continental level, thereby creating environments that will be less susceptible to corruption.

Figure 3: IP in various African subregions as of March 2020

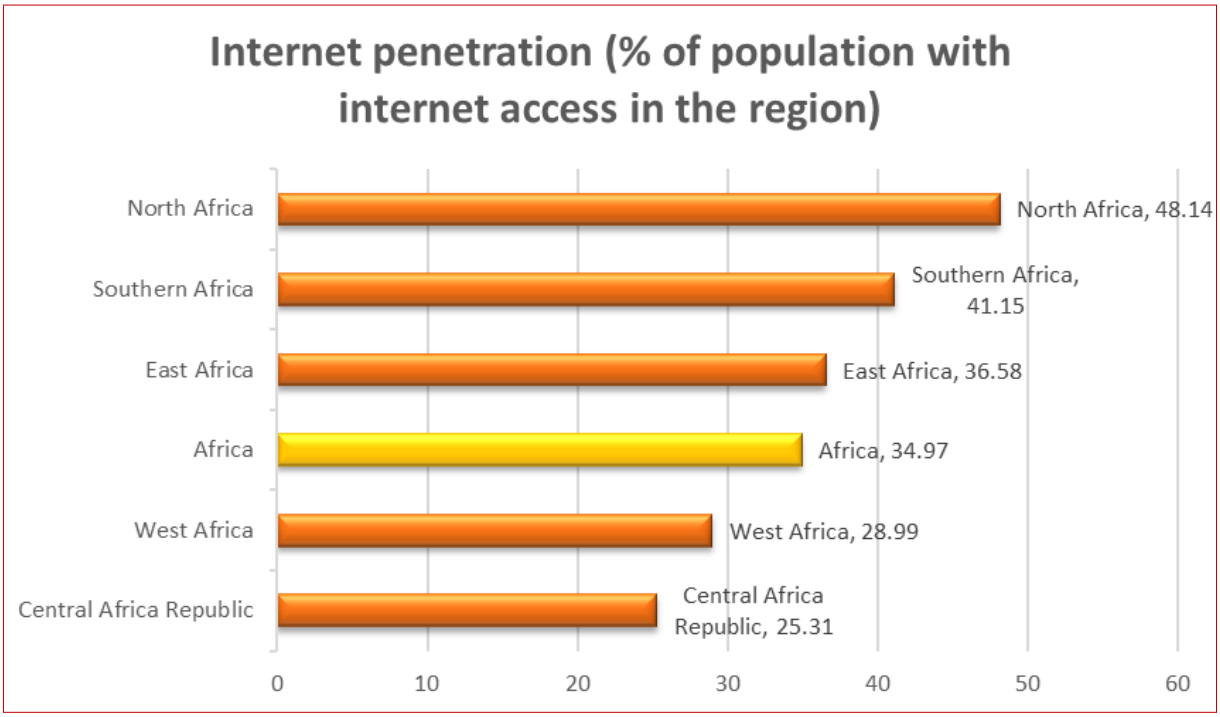


Figure 3 shows IP in various African regions, including a significant drop from North Africa down to West Africa and the CAR. This shows that a bottom-up approach could be utilised by allocating most new resources to high-risk regions such as Central and West Africa. Planners should realise that the continent is interconnected, and so is corruption.

Conclusion

Corruption is a major obstacle to African growth and development. It corrodes governance, and undermines service delivery. In turn, this undermines civil relations with government, as well as citizens' faith in democracy. This is illustrated by the numerous Covid-19 corruption scandals across the continent, at the expense of ordinary citizens.[20]

The paper has demonstrated that IP is linked to perceptions of corruption. This means that corruption can be combated by higher levels of investment in ICT, resulting in better information flows, and a more active citizenry. Following from this, it recommends that the 4th industrial revolution be leveraged by investing in e-governance, which could improve governance, citizen participation, service provision, and ultimately the wellbeing of Africa's people.

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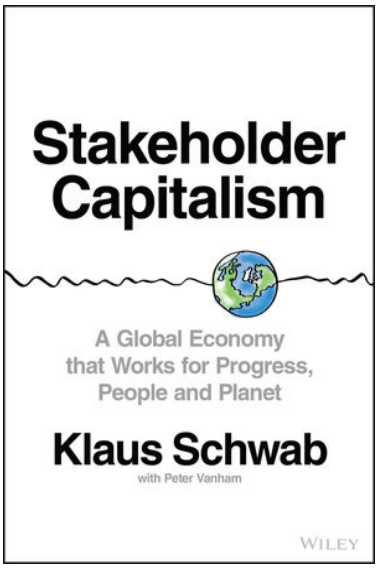
BOOK REVIEWS

Stakeholder Capitalism: A Global Economy that Works for Progress, People and Planet (Klaus Schwab with Peter Vanham)

O'Brien Kaaba, LLD
University of Zambia



Klaus Schwab with Peter Vanham, *Stakeholder Capitalism: A Global Economy that Works for Progress, People and Planet*. John Wiley and Sons. 2021. 248 pp. US$29.45.

Is there an alternative to the current shareholder capitalism model of economic development? The book *Stakeholder Capitalism: A Global Economy that Works for Progress, People and Planet*, authored by Klaus Schwab, the founder of the World Economic Forum (WEF), published in 2021 compellingly argues that there is an alternative. Not only is the alternative necessary but an emergency that ought to characterize the global economic world in order to protect and assure the sustainability of development and the welfare of future generations. He calls this stakeholder capitalism.

In order to understand Schwab, it is necessary to outline the factors that have led him to propose a new model of economic development. He starts by acknowledging the unparalleled development that has occurred across the world since the end of the second world war (WWII). As WWII came to an end Germany lay in ruins, millions of historic buildings and homes wiped. Germany economy was a wasteland. The impact of the war was felt around the world. Only the Americas, led by the United States, had come through the war largely unscathed.

After WWII, the USA wanted to revive the European economies that lay within its sphere of influence. It wanted to promote trade, integration and political cooperation. Through the Marshall plan, the US helped Western European countries purchase American goods and rebuild industrial Europe. It also encouraged trade by setting up European markets for coal, steel and other commodities, leading to the ultimate creation of the European Coal and Steel Community, the predecessor of the current European Union.

These efforts led to a surge in global development in the last 75 years, leading to many people to live long and mostly health lives. This development has also been characterized by advances in technology, abundances in energy and global trade. This development has not just been in Europe and America but Asia as well, led by the emergence of China and India, lifting millions of people out of poverty.

A weakness in Schwab's tracing of the global development in the last 75 years is that it pays little attention to Africa. Apart from the occasional isolated examples drawn from Africa,

there is no systematic treatment of the development path of Africa. To this extent, there is no way of understanding how Africa fits both in the past development model and how it would fit in the stakeholder model Schwab later proposes in the book.

Schwab criticizes the development model of the last 75 years as it has inherent weaknesses leading to income inequality and dangerous levels of unsustainability. To substantiate this, he elaborates three clusters of weaknesses, based on the views of Simon Kuznet, the Russian-born American economist. These are the declining gross domestic product (GDP), income inequality and environmental degradation.

With regard to GDP, Schwab starts by first noting that in developing the GDP as a measure of economic development, Kuznet was aware of its inadequacy and had warned that it was a poor tool for economic policymaking: "the welfare of a nation can scarcely be inferred from a measure of national income." This is because the GDP tells about the consumption of products but does not tell about the well-being of human beings. The global economic growth had been at an average of 6 per cent from the end of the WWII to the 1970s, then averaged at about 4 percent until about 2008 when it fell to 3 per cent or lower levels. The global growth is not predicted to improve beyond 3 per cent in about a decade. This problem of slow growth is compounded by rising debt (public, corporate and household, which stood at more than $258 trillion globally in 2020), low interest rates and low inflation, and declining productivity growth.

Second, Schwab highlights the fact that the blind pursuit of GDP growth has led to income inequality, even within developed countries. He argues that although global inequality has declined over the last 30 years, income inequality has worsened within nations. For example, in 2019, 56 per cent of US equities was held by the top 1 per cent of the richest families (amounting to $21.4 trillion).

The third concern is the integrity of the environment. The consumerism that developed concomitantly with the global economic growth has led to exploitation and destruction of natural resources to unsustainable levels. This is evident in the pollution and contamination of water, the dumping of plastics in the oceans and threatening aquatic life, and the pollution of air.

Taking these factors into account, Schwab argues that the time is ripe for another development path. The development model he proposes is stakeholder capitalism. Unlike share holder capitalism which simply focuses on growth and profit making, Schwab proposes a development model that deliberately takes into account the interests of all the stakeholders, including the future generations. At the heart of this model is the survival and health of the planet and the well-being of the people who live on it. As Schwab asserts: "Wherever you are in the world, there is thus an increased consensus that the well-being of people-- wherever they live – and the planet as a whole matter to all of us."

To help bring about the effective implementation of this approach, Schwab identifies four cardinal stakeholders who need to collaborate. These are the governments, civil society, companies, and the international community. He explains the rationale for the four stakeholders as follows:

> Governments, notably, focus on creating the greatest possibly prosperity for the greatest number of people. Civil society exists to advance the interests of its constituents and to give a meaning or purpose to its members. Companies obviously aim to generate an

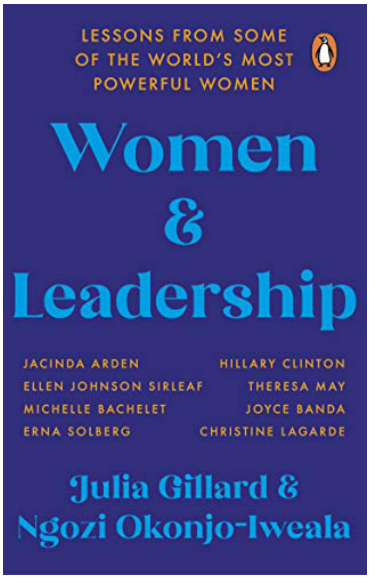
> economic surplus, measurable in profits. And the overarching goal for the international community is to preserve peace.

These stakeholders are interconnected as one cannot succeed without the other.

There is no doubt that the model Schwab proposes is compelling and well argued. However, as alluded to above, the book pays scant attention to the African context. This makes it difficult to relate the findings and the proposed solution to the African context. For example, while bemoaning the, slow global economic growth that has been at less than 3 per cent, he acknowledges that Sub-Saharan Africa has, however been growing at an average of more than 5 per cent. He, however, explains this away by referring to the high rate of population growth in Africa, which makes it insufficient to support a rapid per capita income growth. Further, it is not clear how distinct the stakeholder model is from the various forms of socialism adopted by many African countries in the aftermath of independence as the development model, which emphasized humanism and de-emphasized profit making and exploitation of the workers. This gap in information in the book, however should not detract from the seriousness of the issues identified in the global economic order. If anything, it brings to the core the need for African locally generated knowledge to articulate concerns in a contextually relevant manner, propose viable solutions to common continental problems and place the continent on a footing of participating in the global economy from a perspective of well informed discourse about the nature of its problems and the possible remedies to those challenges.

Women and Leadership: Lessons from Some of the World's Most Powerful Women (Julia Gillard and Ngozi Okonjo-Iweala)

Lesego Motsage, BA
University of Johannesburg
lmotsage@uj.ac.za



Julia Gillard and Ngozi Okonjo-Iweala. *Women and Leadership: Lessons from Some of the World's Most Powerful Women*. Penguin Publishers. 2021. 336 pp. R210.00.

Women are often described as the pillars of society and the pioneers in political, economic and cultural life. Therefore, it is important that women are given the platform and equal opportunities to be able to lead in the workplace, to participate in the economy and have a say when it comes to politics. However, the above is not always the case, as women in this day and age and across the world are still not treated equal to men. Some societies and industries appear to have a hard time accepting that a women's role in society is changing. But many 21st century women have realised their full potential. Women are no longer just staying at home and raising children whilst looking after the household. Instead they are taking up space and cementing themselves in what is considered male dominated space, politics; both international and domestic. However, it is a bit hard for them to unleash their true potential because there are obstacles that are put in place to intentionally make it hard for women to excel. In response to this, Julia Gillard and Ngozi Okonjo-Iweala saw a need to write a book on women and leadership.

According to the Gillard and Okonjo-Iweala " women leaders all seem to be facing the same kind of problems." In the book, the authors set out to interview and discuss the lives and journeys of 8 formidable women who are powerhouses and have been the first (or close to being first) to hold the highest positions of power in their respective countries, the authors also draw on their own personal experiences. One gets an insight into each of these influential women's journeys into politics -- the good, the bad and the ugly. The women leaders are Hillary Rodham Clinton, Theresa May, Joyce Banda, Christine Lagarde, Jacinda Arden, Michelle Bachelet, Ellen Johnson Sirleaf and Erna Solberg. The book is written in a conversational style. In its methodological approach, it tests out and analyses 8 hypotheses based on the experiences of these female leaders. The hypotheses are given the following names: (1) You go girl; (2) It's all about the hair; (3) Shrill or soft; (4) She's a bit of a bitch; (5) Who's minding the kids; (6) A special place in hell-do women really support other women; (7) Modern day Salem; and (8) The role modelling riddle. The book concludes with a section that summarises the lessons found throughout the book.

Gillard and Okonjo-Iweala seeks to answer the question of why there are so few women at the top of politics. They greatly achieve their goal because the book adequately brings to light the inequalities (pay gaps), glass labyrinths and ceilings, sexism and stereotypes from

the media and society that women leaders are faced with everyday in their political careers and therefore hinder them from holding the highest leadership positions. An impressive aspect is that the authors provide scientific evidence to prove majority of the statements and observations that they make. The book is well researched in that regard.

There are a few more aspects that stand out in the book. The first is Hillary Clinton's life changing presidential campaign. Had she won, she would have been America's first female president and this would have been a huge win for women throughout the world. Another intriguing aspect was the book's detailed treatment of Jacinda Arden's inspiring life story, more especially the part where she discusses her pregnancy and giving birth whilst serving her term as Prime Minister and carrying out that motherhood role so effortlessly whilst being constantly criticised about her life choices. Another interesting aspect of the book is that, even though it is focused on women and leadership, it gives men advice on how to be part of the solution and not the problem. Gillard and Okonjo-Iweala go on further to give crucial advice to the media: "Whenever you write a story about a woman, replace her name with a man's name and see if you would still write it, to check if you've used harmful stereotypes you wouldn't use for a man." This is probably the best unsolicited advice that the media has ever received.

The authors claim that "in order to be it, you need to see it." They hope that young woman from around the world will read the book and be encouraged because they will see a reflection of themselves in these incredible women leaders and be inspired. That if these women who look like them and are from similar backgrounds as they, they too can do it.

However, the book does fall short when it comes to representation. In particular, it lacks representation of Asian and Hispanic women leaders. Young Asian and Hispanic females reading the book might struggle to relate with the book because there is not a single female leader from their parts of the world or background that was interviewed and contributed to this book. The book would perhaps be even more impactful if it included the likes of Maria Teresa Fernández de la Vega who was the first Hispanic deputy Prime minister as well as Minister of the Presidency in Spain and Megawati Setiawati Sukarnoputri who served as the first President of Indonesia. Another shortfall of the book is that, in some sections, not much awareness was given to the responses from the interview questions, the authors could have put more effort in dissecting the statements made by the interviewees throughout the book. Instead, the authors mostly include their own analysis and observations from the interviews especially in 'You go girl' and 'A special place in hell – do women really support women?' Arguably, the book would have been even more valuable had it explored the aspect of intersectionality and included more insight and lessons on breaking the glass ceilings and overcoming the obstacles mentioned in the book.

Overall the book is very thought-provoking, well written and researched, the findings presented by the authors to prove their hypotheses were shocking but not surprising. In the concluding section of the book, the authors urge young women "to be aware" and "not beware." In other words, despite all the gender inequalities and obstacles discussed in the book, they want young women to pursue careers in politics and top leadership positions. The book is not very vocal on wanting to overhaul the system, but it is about women learning to navigate their way through the system while changing it bit by bit. The lessons from these inspiring women could apply to anyone not just young females who aspire to get into the political field. The world needs more leaders like these ten incredible women, and it is so inspiring to know that it is possible for all types of women to overcome the stereotypes and all manners of glass to become top leaders. The book is definitely worth a read.

Nyamadzawo Sibanda, MSc
University of the Witwatersrand

Adams, R.; Pienaar, G.; Gastrow, W.; Olorunju, N.; Gaffley, M.; Ramkissoon, Y.; Van der Berg, S.; Adams, F.; Thipanyane, T. HSRC Press. 2021. *Human Rights and the Fourth Industrial Revolution in South Africa*. 168 pp. R185.

In this seven-chapter report, the authors present a guide to the policy development of human rights-based fourth industrial revolution (4IR) policies in South Africa. Based on the input given during a workshop organized by the South African Human Rights Commission (SAHRC), at the beginning of March 2020, the comprehensive report covers various areas in which artificial intelligence (AI) and 4IR technologies are employed, or to be employed, in South Africa. The authors lay a foundation for the discussion within the current social-economic and political development landscape of South Africa, through their engagement with the various development policy trajectories as they conceptualize technological transformation. In the same breath, the report acknowledges that any successfully implemented 4IR policy regime would have to acknowledge and engage sources and dynamics of current socio-economic challenges in the country, such as unemployment, poverty, and inequality (p. 1; p. 93). The argument put forward in this regard is that while the anticipated technological transformation is meant to help various facets of South African life (p. 8-12), ignoring the extant challenges could hurt any chance of beneficial technological transformation (p.58). In Chapter 2, the report engages various aspects of data governance in South Africa through an analysis of various pieces of extant policy, with a comprehensive comparison to international (UNHRC) and regional (ACHPR) policy instruments. While the report acknowledges the nascency in the development is such policies, both internationally and within the country, it also notices various lacuna in the extant policies. Of concern are various implementation gaps in most sectoral (DSI, DCDT, DTIC) statutes in South Africa.

The use of AI and 4IR technologies to support law enforcement and court systems are also acknowledged as being in infancy in the country, compared to regional and international standards (Japan, Australia, Hong Kong, China) (p. 50). However, the authors do not see this as an indictment of progress and human rights, as they point to negative externalities of technological progress in these areas as experienced in other countries like China ((p.52). In this regard, they raise cautious optimism about the prospects of embracing certain technological facilities due to possibilities of bias and negative discrimination. Caution is also raised in the issues of policymaking regarding the implementation of 4IR in the context of perceptible discrepancies in the digital divide, along with gender, race, and location divide. According to the authors, introducing substantive 4IR revolution policies that are blind to extant inequalities in this regard has real possibilities of accentuating this schism. As such, targeted interventions in bridging the gap between technological infrastructure, knowledge,

and practices must precede and implementation of advanced technological services. These transformative interventions must also inform an epistemological shift that acknowledges not only that citizens' rights online are similar to those they enjoy offline, but also a sense of responsibility for digital citizenry: a balance between what constitutes freedom of expression and hate speech – cybersecurity and cybercrime. Lastly, the authors acknowledged that any human rights-based 4IR policy regime will acknowledge South Africa's unique position in terms of socio-economic rights. As constitutional rights, various socio-economic rights (especially education and healthcare) stand to be helped by the adoption of various technological facilities that constitute the 4IR. While the future of work, in education, healthcare, and other areas, may face short-run challenges as a result of the adoption of progressive technologies, the service provision aspect may experience huge boosts in efficiency and expand the realm of the possibility. Most service delivery in various socio-economic sectors struggle with aspects of transparency, responsiveness, and accountability; adopting AI and 4IR technologies, especially in algorithms and informatics can assist in expediting some of these challenges.

In Chapter 7, the authors reiterate their purpose of offering a policy-making guide in creating a human rights-based 4IR policy regime in South Africa. They see this as possible by focusing on three aspects: (i) the development of 4IR policies; (ii) re-conceptualization and capacitation of constitutional and statutory bodies related to 4IR and human rights, and; (iii) providing awareness and understanding of 4IR and human rights within communities. While acknowledging the comprehensiveness of the South African constitutions in enunciating and protecting human rights, and instituting various bodies (Chapter 9 institutions), the report acknowledges the gap in the implementation of various statutes (PAIA & POPIA) and capacitating statutory bodies such as Information Regulator South Africa (IRSA). This as they argue has ensured that while certain rights are protected through the constitution and various statutes, they remain unrealized due to lack of implementation or enforcement. As such, policy formulation in terms of regulating 4IR technologies must be inclusive and transformative if they hope for a human rights-based approach. In addition, constitutional and statutory bodies charged responsible for ensuring that various rights are observed and protected must collaboratively engage in defining the 4IR space, as well as receive the necessary capacitation to carry out their duties. Finally, while the supply-side of a prospective human rights-based 4IR regime must be enabled, the demand-side need interventions in awareness and capacitation to take full advantage of the changes and facilities afforded by the technological transformation, while protecting themselves and others.

This is a crucial and timely seminal work on one of the global topical subjects. As argued in the report, 4IR while crucial, has been used as a heuristic for several technological changes experienced in the country (p. 21). Normatively, 4IR is seen as a cross-sectoral panacea to many national challenges and priorities. The report does a great job covering many major sectors in which technological transformation associated with AI and 4IR are likely to lead to human rights concerns. It rightly discusses the "double-edged sword" (p.12) effect of 4IR, and charts various sectoral and national remedies to a number of possible violations. While international concern on progress in AI and related developments is pervasive, the current report is one of the few comprehensive treatises on the subject. The report is mainly targeted at public officials and private actors, who are responsible for advocating for and creating regulatory and substantive policies and sectoral statutes. A lot of experience has indicated the need for cautious optimism as we embrace many developments associated with "the internet", yet many actors overemphasize the 'optimism' and overlook the caution. Emanating from the national human rights institute (NHRI), SAHRC, the report justifiably dwells on cautioning various actors responsible for designing and implementing 4IR policies. The authors do

this meticulously by grounding their arguments on the contextual realities of South Africa. They then argue, and rightly so, that the issues of digital rights must supervene from basic socio-economic rights. The resolution of inequality, in access and outcomes, poverty and unemployment must be prioritized even as the country tends towards technological progress. One would even argue, that the report does not emphasize, that South Africa has the moral obligation to prioritize the adoption of 4IR technologies that would enable the delivery and access of various socio-economic services. Discretionary innovation is a running theme in the report, mainly achieved through comparison with international and regional practices. The report also recommends the institutionalization of human rights impact assessment (p. 57) to ensure that whatever technologies are adopted are human rights compliant.

The report deals comprehensively with the nexus of privacy and cybersecurity. As already gleaned from experiences with social media and various information management systems within public and private organizations, the inception of 'the internet' has led to the need to re-conceptualize our understanding of the right to privacy and freedom of expression in a manner that embraces conventions on cybersecurity. As rightly averred, 4IR is data- and information-driven. It is important therefore for national policies to ensure that personal data and information with individual implications be treated with respect. The report deals comprehensively with this theme in Chapters 3 and 5, arguing that while South Africa has pieces of legislation regulating access to various pieces of information and freedom of expression, regulatory safeguards need to be vigilantly enforced to ensure that these rights continue to be enjoyed by all.

However, the overemphasis on drafting regulations loses sight that South Africa has one of the more elaborate rights-based institutions in the region. The issue becomes implementation, monitoring, and evaluation. While communal awareness and capacitation are crucial for participation in the 4IR and ensuring bulwark against rights violations, however, another crucial aspect of implementing a human rights 4IR regime is securing buy-in from various street-level bureaucrats. Ensuring substantive monitoring of such compliance will be crucial in achieving the stated objective, yet the report has de-emphasized this. Another blindside in the report is the conceptualized relationship between 4IR and human rights. In most cases, the authors argue that the unregulated embrace of 4IR technologies in various sectors will either exacerbate extant human rights challenges or produce new ones (p.58). While this is a pertinent point in the context of South African inequalities, the report fails to sufficiently raise optimism on the role of 4IR in bridging the inequality gap in information and opportunity access. It is a fact that countless examples of individuals and organizations have benefited from technological advancement. Several scholars have conceived of the internet "as the great equalizer"- enabling individuals and organizations access to a global wealth of relevant information which would have been otherwise the preserve of the privileged in a pre-internet epoch. The authors missed the opportunity to show how 4IR technologies could be used to bridge the gaps between social groups in South Africa. However, these minor omissions do not dent the value of this comprehensive and novel report, with clear national and trans-national applicability.

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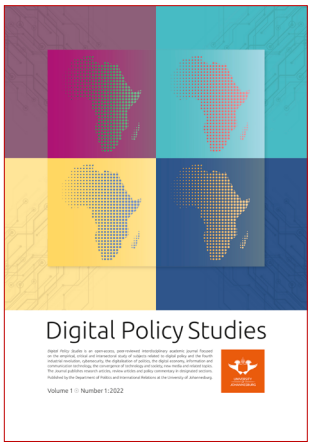

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