Safe Computing for Emerging Economies

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Edited by

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This book is dedicated to the Department of Computer Science and Information Technology of Igbinedion University, Okada, Edo State of Nigeria.

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EPIGRAPH

THE IMPACTS OF CYBERSECURITY ON THE EMERGING AFRICAN ECONOMIES

Current literature assumes a "one size fits all" approach to the use or impact of technology on national development and economic growth. Some nations are already developed whereas others are struggling with development. Some national economies are mature and stable whereas others are still fragile and very much unstable. Technological advances do not impact on national development and economic sustainability in the same way and to the same extent. There is a great technological and developmental divide between the rich and developed countries and their stable economies on one side, and the poor and developing countries and their fragile economies on the other. This may or not be anyone's fault, but it is a fact of the life we live.

The goals of the research are simply to build a bridge for the great divide; to investigate and generate original articles that elucidate the problems of the developing countries and their struggling economies which are caused by the great digital divide; to bring to light the impacts of safe/unsafe computing on the general development and economic resiliency level of the developing countries; to enable grass roots' informed participation in their national and economic development; to provide national leaders and legislators with tools for effective policy decisions; and to enable general public awareness of these problems and their solutions. As it is said, to be well informed is to be well armed.

The purpose of this publication is to widely disseminate the information content of the collection to the world of academics, economists, computer science and information technology professionals, political leaders, governmental agencies, and indeed the rest of the world, particularly those in the developing worlds or emerging economies. This collection includes articles from academic professionals, computer scientists and information technology experts, renowned economists, legal practitioners, etc., each

investigating the same problems and solutions from their areas of professional expertise. Most of the contributors to this collection are widely and internationally known professors and senior lecturers, many of them have Ph.Ds and expertise in their areas.

FOREWORD

This book is a welcome outgrowth of the 2nd COMPUTER SCIENCE CONFERENCE ON CYBERSECURITY AND THE EMERGING AFRICAN ECONOMIES, hosted by The Department of Computer Science & Information Technology, Igbinedion University, Okada, and Edo State of Nigeria, October 24-26, 2016. The apt conference theme, THE IMPACTS OF CYBERSECURITY ON THE EMERGING AFRICAN ECONOMIES clearly highlighted the core ideas of the discussions. The participation of most sectors of the Nigerian and African societies assured the reflection of a widely representative perception of the informed public on the theme. The appropriateness of the elucidation of the Nigerian national ICT strategy and state of affairs by His Excellency, Barrister Abdur-Raheem Adebayo Shittu, Hon. Minister of Communications, Federal Republic of Nigeria, cannot be overemphasized. The outline of the hotly debated and discussed ideas and issues are presented in this book.

Editor-in-Chief: Rev. Prof. Longy O. Anyanwu, Computer Science & Information Technology, Igbinedion University, Okada, Nigeria

PREFACE

With the prevalence of the unpredictability of the world and its economies, Nigerian computing professionals, like others, have long awaited the coming of age of an appropriate national forum to sensitize the issues of computing security as they impact the emerging African economies. Although information circulation for this conference and many other events in Nigeria, and indeed the third world has challenges, it successfully exceeded our expectations in public interest. These selected papers are among the high quality original work coming out of the conference.

Conference Keynote Speakers

Top-notch and brilliantly impressive keynote addresses were made by two top nationally and internationally acclaimed and much sought after expert authorities.

1) His Excellency, Barrister Abdur-Raheem Adebayo Shittu, Hon. Minister of Communications, Federal Republic of Nigeria, Abuja. Minister Shittu is an internationally noted technology wizard, a man of lofty ideas suited for this age of technological enigma. That a man of this caliber and authority is at the helm of technology affairs, gives Nigerian youth hope for a brighter future.
2) Dr. Sylvanus A. Ehikioya, Ph.D., Director, New Media and Information Security, Nigerian Communications Commission, Abuja. Dr. Ehikioya is an accomplished scholar and has published over 77 peer-reviewed technical research papers in international journals, book chapters, and conference proceedings. He is a reviewer for many international journals. Dr. Ehikioya is a member of the Committee to Assess National Communications/Surveillance Assets, and a member of the Ministerial Committee on National Software Development, and the CEO of Rochester Technologies Limited, Abuja.

Prof. Longy O. Anyanwu
Editor-in-Chief & Chair, National Computer Science Conf. Organizing Committee

ACKNOWLEDGMENT

The Editorial Board and the National Conference Organizing Committee (Prof. Longy O. Anyanwu of Igbinedion University, Prof. Ibrahim Bayo Mamodu of Ambrose Ali University, Prof. Charles Uwadia of University of Lagos, Assoc. Prof. J. Akpojaro of Samuel Adegboyega University, and Dr. H. Soriyan of Obafemi Awolowo University) extend their gratitude to all who contributed to the success of this conference by way of paper submission, paper editing, conference sponsorship, guest speaking, publication, information dissemination, conference organization, and other contributions.

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CHAPTER ONE

INTRODUCTION: THE NIGERIAN GOVERNMENTAL PERSPECTIVE

The keynote address of His Excellency, Barrister Abdur-Raheem Adebayo Shittu, Hon. Minister of Communications, Federal Republic of Nigeria, Abuja, at the 2nd national computer science conference on cybersecurity & the emerging African economies, at Igbinedion university, Okada, Edo state, Nigeria on October 24th, 2016.

It gives me great pleasure to be here to give this keynote address on this important occasion of the 2nd National Computer Science Conference with the theme "Cybersecurity and the Emerging African Economies."

I wish to thank the organizers of this Conference for choosing this theme, which cannot be more appropriate in any discussion on the present global economic realities. The internet and digital technologies are the biggest transformational forces in the world today. There are over five billion internet-connected devices globally and in 2015 online commerce contributed over $10 trillion to the global economy. The changing nature of economic and territorial threats have raised global concerns. The growing role of cyberspace has opened up new threats as well as new opportunities. This country must find ways to confront and overcome these threats if we are to remain functional as a sovereign entity in an increasingly competitive and globalized world.

No doubt numerous conferences such as this are being held across the globe to brainstorm on how to leverage the gains of ICT to provide rapid changes in technology, social, political and global economic transformation. Today, as always, the world is faced with the challenges of crime and security. These challenges in today's world, however, are not just physical but also electronic. The new post-modern realities of ICT and cyberspace have extended the frontiers of living space from physical space to cyberspace. As we all know, innovations in ICT are rapidly altering the landscape of global economies. From business, industry, government to

not-for-profit organizations, cyberspace has simplified business processes in a real-time processing mode. Since 2000, the African continent has experienced a prolonged commodity boom and a sustained growth trend. Highly regarded international organizations such as the African Development Bank have asserted that Africa is home to some of the world's most rapidly growing economies. This is reflected in the continent's expanding middle class and rapid adoption of mobile technology.

The Cyberspace

Today, in comparison to physical space, cyberspace is virtually co-ubiquitous, operationally more efficient, socio-politically more vibrant, economically as resourceful, and information-wise more integrated. Given its ubiquity, scale and scope, cyberspace has become a fundamental feature of the world we live in. In the developed world, cyberspace is well patronized; while, in the developing world, it is becoming increasingly patronized. Due to all these realities, crime and criminality have also moved into cyberspace with increasing sophistication. Cybercrime and attacks are on the increase and it appears the internet is no longer safe, considering the emerging threats and the number of attacks being recorded daily. Today, we are being faced with a series of challenges such as Ransom-ware, Virus, Trojans, Phishing, Spyware, Mal-advertising, Man in the Middle, Man in the Browser, Hacking, Spoofing, Denial of Service, Distributed Denial of Service attacks, Website defacement, Cyber espionage, Pharming, Cyber terrorism, Internet of Things (IoT) and many more. Recently, the National Information Technology Development Agency (NITDA), an agency under my ministry said that Nigeria lost about NGN 159 billion, in the last thirteen years, to cybercrime. We, in the Ministry of Communications, are deeply shocked by this development. In focusing on the repeated assertion of President Muhammadu Buhari's administration that ICT is the envisaged bedrock of Nigeria's Change Agenda, the Ministry of Communications is leveraging the active support of the ICT stakeholders by building all the requisite ICT and cyberspace capacities in Nigeria.

The Growth of Cybercrime

Cybercrime is a growing global phenomenon that has assumed the status of a multibillion dollar industry. Though it has increased in intensity globally, according to a report by Symantec Corporation, issued in 2013,

the increase is at a more rapid rate in Africa than in any other area of the world. Cyberspace has the potential to deliver socioeconomic development; however, it needs to be open and accessible to all as well as safe and secure. There is no doubt, tackling cybercrime remains an enormous challenge that requires the engagement of a range of stakeholders and academia. We can build coalitions and take steps to reduce the scope and scale of cybercrime. In major African cities, such as Cairo, Johannesburg, Lagos and Nairobi, the rate of cyber-related offenses, such as fraudulent financial transactions and child kidnapping, especially in Kenya, facilitated through internet communications has increased in recent years. The use of ICT in carrying out terrorist attacks throughout Africa is adding new dimensions to the cybersecurity issue.

In order to stem cybercrime explosion, African leaders need to understand the magnitude of cybercrime; its impact, emerging threats and how other countries of the developed world have responded. Therefore, African countries need to urgently scale up efforts to combat cybercrimes through a multi-stakeholder approach involving government, industry and civil society organizations within the context of the African Union Convention on Cyberspace Security and Protection of Personal data. This is necessary to stem the threats posed by cybercrime and cybercriminals to national economic security. If African leaders fail to address this threat, there will be negative impacts on economic growth, foreign investment and security.

It is my hope that this Conference will be able to develop unique national responses. I am glad the Cybercrimes Act 2015 has been passed into law, even though many stakeholders are clamoring for an amendment. An effective response to cybercrimes requires robust network security, including appropriate network architecture and software, use of encryption, data protection legislation, information security standards and other tools of threat protection and detection. Other counter measures:

a) Increase the awareness of ICT and cyberspace stakeholders on the need and possible strategies for combating and defeating cybercrime in all its ramifications and reduce the risk of data breaches and financial losses;
b) Improve the capacity of relevant ICT and cyberspace stakeholders for the training and support of cybersecurity officials;
c) Share cybersecurity best practice from across the globe;
d) Build the capacity of local law enforcement in cybercrime prevention and cybersecurity footprint;

e) Ensure our curriculum adopts internet security education and advanced application development for capacity building;
f) Encourage continuous research for development of indigenous security solutions, applications and tools to combat emerging threats in the fifth domain;
g) Building different layers of security defense such as installing Anti-virus tools, Firewall, Intrusion Prevention System (IPS), Intrusion Detection Systems (IDS), Data Loss Prevention (DLP), Honey Pot, System On Chip (SOC) and many more;
h) Show effectual strategies for drawing on the strengths of telecommunications in their efforts to tackle cybercrime;
i) Ladies and Gentlemen, there is a new prospect for cybersecurity and emerging trends in our world today. Cybersecurity is extremely important in ensuring local, national and global security. In the face of rising global insecurity and terrorism, the ministry is ready to partner with agencies to catalyze and develop world-class human and institutional capacity in cybersecurity.

The Need for Cybersecurity

The need for other frameworks like cybersecurity awareness across business; cooperative arrangements between law enforcement and communication service providers across the nation and a criminal justice system that facilitate the efficient prosecution of cases of cybercrime is very germane. As we plan to settle into our duties of protecting our individual or corporate data, we ought to be continuously conscious of the reality of the cyber woes out there. Hence, there can be no better time to emphasize the need for strategic, continuous and innovative plans with respect to protecting our cyber space. The ministry, in its effort to combat cybercrimes, has taken on the responsibility to sensitize, raise awareness and impart skills on cyber protection. A Computer Emergency Response Team is also being created to handle computer security incidents. The implementation framework for the Cybersecurity Act is being examined by my ministry, with amendments made where necessary, in collaboration with the Office of the National Security Adviser. Nigeria will soon assent to the Budapest Convention, whose main goal is to establish a common criminal policy to better combat computer-related crimes worldwide through harmonizing and improving international cooperation. Taking into consideration the present administration's commitment to job creation, revenue generation and security, I hereby charge you to galvanize your solutions to key into the SMART Government to deliver ICT to Nigerians

since the sector is crucial to the overall development of the country. It can contribute to wealth creation and it has also become one of the most important tools for fighting crimes and terrorism in the country.

Ladies and gentlemen, it will interest you to note that today Nigerian youth accounts for about 43% of our 178.5 million estimated population. Sadly, about 25% of them are either unemployed or underemployed because their education and skill training is inadequate to meet the demands of modern-day challenges. This limitation poses a great challenge to all the Nigerian universities represented here, and by extension, to the present administration. Therefore, I enjoin you all to use ICT as a platform to churn out qualified manpower for the government and the private sector's needs. It is also worthy of note that Nigeria currently loses about NGN 78 billion annually to the activities of cyber criminals whose major targets are financial institutions, government ministries, departments and agencies as well as their affiliates. There is, therefore, the need for the enactment and enforcement of policies to ensure cybersecurity within the ICT and financial institutions. Such policies should address the framework of cyber risk management, enforcing security through a "defense in depth" strategy as well as enforcing vigilance through an early detection and signaling system.

The Plan and Appeal

Although, a series of workshops have been held to address this menace, and recommendations made to the Ministry of Communications for the administration's intervention, yet, may I humbly use this forum to appeal to academia to take this as a major challenge to develop talents who can design software and programs to check the activities of these cyber hoodlums? The Ministry of Communications is drafting a bill to unbundle ICT infrastructure with a view to boosting the national economy. The draft bill is aimed at increasing private participation in ICT, which will lead to an increase in revenue generation. ICT could compete favorably with the oil and gas sector in terms of job and wealth creation for the country; however, one of the major challenges confronting the development of the sector is obsolete laws. The country needs to review these laws and also invest more in the sector in order to unlock the huge potentials therein. In addition to other measures, the ministry plans to convert the Digital Bridge Institute into a Multi-Campus ICT University; perhaps the first of its kind in Africa. The country does not have a dedicated institution for awarding ICT degrees. We believe that ICT goes beyond Computer Science as a

course. The government will re-engineer the economy by promoting and encouraging ICT entrepreneurship to stimulate the nation's economy. The government will also stimulate the economy through the provision of ICT-based services, and will make deliberate efforts to adopt the use of ICT in every aspect of our endeavors in order to improve efficiency, effectiveness and productivity in service delivery and business transactions generally. The government would like to see more small and medium-sized ICT enterprises come up with solutions to the myriad of challenges that we face as a nation.

Ladies and gentlemen, I look forward, therefore, to a fruitful engagement and urge you all to take keen interest in all discussions at this conference so as to ensure that the conference comes up with strategies that will build a better and safer cyber space for all. I am optimistic that effective strategies to curb the menace of cybercrimes will evolve from this conference. Such strategies should include cyber resilience by preparing for the known, unknown, predictable and unpredictable risks. For my part, I want to assure you that I am prepared to fully collaborate with you to fight these cancerous growths in our cyber space. You should therefore, feel free to submit to me any doable blueprint for my consideration and immediate implementation.

Before I conclude my address, let me reiterate the words of Newton Lee, an author and administrator in the field of education and technology commercialization, which says: "As the world is increasingly interconnected, everyone shares the responsibility of securing cyberspace." It is therefore clear that with greater cooperation by all stakeholders including academia, we will be able to secure our cyber space and thus move the ICT sector forward. I am convinced that by the Grace of Almighty God and the sheer will and determination of the Nigerian people, we will come out stronger and more united than ever.

I congratulate you all for being a part of this all-important conference and wish you very fruitful deliberations.

Thank you for your attention and God bless the Federal Republic of Nigeria.