The unique approaches proposed in this book are 'glocal' in character, as they draw on the experiences of South Africans to address the global issue of 'smart communities'. The book blends together social and technical aspects, and presents the experiences from a range of community practitioners, academics, architects and engineers.

Dr Jackie Phahlamohlaka completed his MSc in Computational and Applied Mathematics at Dalhousie University, Canada, and his PhD in Information Technology at the University of Pretoria, South Africa. He is currently a Chief Researcher at the Council for Scientific and Industrial Research (CSIR). He is the founder of SEIDET and the Chairman of its Board of Directors. He completed the Executive National Security Programme (ENSP) at the South African National Defence College in 2007. He is an Honorary Fellow of the Institute of Information Technology Professionals of South Africa, and is a member of the South African National Committee for the International Federation for Information Processing. His research interests are in ICT and socio-economic development, web-based group support systems, broadband access, and national security.

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Approaches to Building a Smart Community

Jackie Phahlamohlaka

APPROACHES TO BUILDING A

SMART COMMUNITY

AN EXPLORATION THROUGH THE CONCEPT OF THE DIGITAL VILLAGE

EDITED BY
JACKIE PHAHLAMOHLAKA

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FOREWORD

In 2008, the book titled *Community-driven Projects: Reflections on a Success Story: A Case Study of Science Education and Information Technology in South Africa* edited by Dr. Jackie Phahlamohlaka was released. The book captures the birth and activities of a community-based voluntary education improvement and development organization that originated from the Siyabuswa community in Mpumalanga. The organization is called the Siyabuswa Educational Improvement and Development Trust (SEIDET).

This book, *Approaches to Building a Smart Community: An Exploration Through the Digital Village Concept*, which captures the renewal journey, is long overdue, and appropriately is also edited by Dr. Jackie Phahlamohlaka.

I met Dr. Phahlamohlaka when I was doing my PhD in 1995 at the University of Pretoria. Jackie opened the door to the Seidet community for me, and participated in one of the research case studies in my PhD. Jackie later became a valued colleague in the Department of Informatics at the University of Pretoria. Regular visits to Seidet established a strong mutually beneficial relationship between the Department of Informatics and Seidet.

From the first chapter where the narrative for a new Seidet is given by Vusi Ndala, it is clear that Jackie thought carefully about the story that this book needs to tell. All the chapters are grounded in research and provide excellent guidelines and examples on building a smart community. The reason for building a smart community is explained by Linda Malinga and Dr. Jackie Phahlamohlaka. The thoughts and research that led to the new Seidet are clearly articulated in Part 3 by the authors: Dr. Jabu Mtsweni, Dr. Flora Modiba, Herman le Roux, and Dr. Jackie Phahlamohlaka. Focusing on infrastructure and cybersecurity issues, Karabo Mokaba, Sydney Lefifi, Zama Dlamini, Dr. Noxy Ncgaba, and Dr. Jackie Phahlamohlaka produce a valuable contribution to the development of a smart community that is often overlooked. In Part 5, perspectives from the ICT for Development (ICT4D) field are incorporated by Dr. Riana Steyn and Lebogang Mohubedu.

Approaches to Building a Smart Community: An Exploration Through the Digital Village Concept is a valuable scholarly resource for researchers, communities, municipalities, ICT professionals, and anybody interested in the journey to build a smart community. The book is edited by Dr. Jackie

Phahlamohlaka, a leader and scholar in the field with years of experience. Reading this book is a journey of discovery—enjoy the journey!

Prof. Carina De Villiers
Head of the Department of Informatics
Chairperson of School of Information Technology
University of Pretoria

PREFACE

The concept of a smart city has attracted global interest; literature abounds and several cities around the world are already classified as smart cities. The same cannot be said about smart communities; yet societies in both developed and developing nations, even in large cities, are made of identifiable communities requiring efficient delivery of services.

With efficiency being central to the concept of "smart" and the quality of lives of people in these identifiable communities dependent on efficient delivery of goods and services, one wonders why this is the case. Why is there a stronger drive to build smart cities (places) compared to that of building smart communities (people within places)? What could be done to synergize these so that the building of smart communities could receive equal global attention? These are some of the key questions addressed in this book.

The approaches in this book on how a smart community could be built are shared by experienced researchers and practitioners based on their personal involvement in various communities over extended periods of time. The contributors to the book have been selected based on their years of personal involvement in community work linked to their areas of research interest, as well as the research interests of the institutions they work for.

Contributions are from South African universities, more than two and a half decades of community ICT work in the Seidet environment as well as from the Council for Scientific and Industrial Research (CSIR) in South Africa. The aim is to draw focus to the building of smart communities through the sharing of unique propositions informed by years of academic work, direct involvement in community development through ICT use, as well as architectural and engineering type experimental development.

We expect that some communities around the globe will find an approach proposed in this book which is attractive enough to them to try out for themselves; by so doing, they will find something that positively contributes to the quality of life of people in those communities.

The book has been subdivided into five parts and ten chapters. Part 1 is composed of one chapter, which gives the premise and context of the book. The narrative of a new Seidet is outlined by its current CEO Mr. Vusi Ndala. Over the years, the Seidet Community Education Centre in Siyabuswa has been used to experiment with various concepts related to ICT and

socioeconomic development. Plans to transform the community center into a smart community center are at an advanced stage. This part and chapter describes the internal transformation processes within Seidet which served as the greatest motivation for writing this book.

In Part 2, which also has one chapter, the significance of the transformation of Seidet Community Education Centre to a smart community center and the rationale for broadly pursuing the building of a smart community is presented by Linda Malinga and Dr. Jackie Phahlamohlaka. This is followed by Part 3 which has three chapters: three approaches for building smart communities. These approaches are a research-anchored, e-entrepreneurship empowerment approach by Dr. Jackie Phahlamohlaka and Prof. Carina De Villiers (Chapter 3.1); the microtasking approach by Dr. Jabu Mtsweni and Dr. Flora Modiba (Chapter 3.2); and the digital ecosystems by Herman le Roux.

Part 4 addresses issues related to infrastructure and cybersecurity. Chapter 4.1 details smart infrastructure as the basis for building a smart community. Sydney Lefifi and Karabo Mokaba from LEMEG Architects, share their architectural journey as well as some results of their work as they collaborated with Seidet to produce the design as well as the look and feel of the Seidet Smart Community Center and the envisaged Seidet Digital Village. Zama Dlamini and Dr. Jackie Phahlamohlaka advise on how to build a cyber smart community in Chapter 4.2, followed by an argument for a cybersecurity awareness and education as a necessary parameter for smart communities presented by Dr. Noxy Gcaza in Chapter 4.3

The last part gives smart community perspectives from ICT4D. In Chapter 5.1, Dr. Riana Steyn shares her experiences about the real ICT need for entrepreneurs as they fight for inclusivity in ICT adoption and use. Lebogang Mohubedu concludes the book in Chapter 5.2 by presenting an approach to securing a smart community.

Jackie Phahlamohlaka, Editor

ACKNOWLEDGMENTS

The approaches to building a smart community contained in this book are based on years of personal experiences and involvement of the authors. Their contributions are gratefully acknowledged.

Further acknowledgment goes to the Siyabuswa Educational Improvement and Development Trust (SEIDET) and the University of Pretoria whose collaboration over more than two decades shed valuable insights used in this book.

Research collaboration with Seidet over the years also came from the Council for Scientific and Industrial Research (CSIR) whose researchers have contributed several chapters to this book. Their contribution is appreciated and acknowledged.

Lastly, this book project started during a sabbatical of the Editor approved by the CSIR in September 2017. Since then, support for the project by the CSIR has taken various forms, including gratefully acknowledged financial contribution for language editing and proofreading costs.

.

Jackie Phahlamohlaka
Editor

CONTRIBUTORS

Dr. Jackie Phahlamohlaka (Editor) hails from Ga-Phaahla Village in Siyabuswa, Mpumalanga Province, South Africa. He completed his MSc in Computational and Applied Mathematics at Dalhousie University in Canada and a PhD in Information Technology from the University of Pretoria. He is currently a Chief Researcher at the Council for Scientific and Industrial Research (CSIR). He is the founder of Seidet and the Chairman of its Board of Directors. He completed the Executive National Security Program (ENSP) at the South African National Defence College in 2007. He is an Honorary Fellow of the Institute of Information Technology Professionals of South Africa (IITPSA). He is a member of the South African National Committee for the International Federation for Information Processing (IFIP) and he represents South Africa in Technical Committee 9 (TC9) of IFIP. His research interests are in ICT and Socioeconomic Development, Web-based Group Support Systems, Broadband access, and National Security.

Innocentia Zama Dlamini is leading the Information Systems and Technology (IST) department at the Moses Kotane Institute in Durban, South Africa. She is responsible for the IT Infrastructure, technology, IT operations, and Information Security assets. Ms Dlamini has worked as a Researcher and Engineer in the areas of Information Security and Digital Forensics for the Council for Scientific and Industrial Research for eleven years. Ms. Dlamini studied for both her undergraduate and honors qualifications in Computer Science from University of Zululand, South Africa, between 2004 and 2007. From her work experience, she grew passion for Information Security and security of the Critical Information Infrastructure. In the future, she intends to pursue her studies in Contemporary Diplomacy in Internet Governance and Cyber Security, focusing in developing countries.

Dr. Jabu Mtsweni is a Head of the Cyber and Information Security Centre at the Council for Scientific and Industrial Research (CSIR), Research Fellow at University of South Africa, and Board Member at Directorate of Information Warfare in the Department of Defence. Dr. Mtsweni has been involved in leading, supporting, and implementing large and complex cybersecurity projects locally and internationally, including projects in large

state-owned enterprises (in South Africa and Africa), government departments, and the military. His research interests and technical expertise are in digital security, digital transformation, cybersecurity, and cybercrimes. He regularly speaks at various local and international conferences on cybersecurity issues. He has over 17 years of academic and industry experience working with different local, regional, and international industries and partners on various ICT projects. He has published over 70 peer-reviewed conference and journal articles with a number of collaborators.

Dr. Florah Sewela Modiba is a development professional in Nelson Mandela University where she facilitates learning, coordinating postgraduate academic programs, as well as supervision of postgraduate students. She is passionate about improving the socioeconomic conditions of South Africa using research to explore innovative ways, especially information and communication technologies, to address social challenges. Her research interest are in the small, medium, and micro enterprises (SMMEs) and informal businesses sectors' impact in development and on how they influence the township and rural economies; development issues and opportunities; gender and development; as well as sustainable community livelihoods and rural development. She has over 12 years' experience in academic and corporate institutions. She has worked in research and development projects in the areas of health, education, SMMEs, and innovative mobile applications for small and large enterprises.

Herman Le Roux has been with the South African Council for Scientific and Industrial Research since April 1998 and is at present the Research Group Leader: Command and Control Systems in the Defence and Security Cluster. He is involved in command and control technology as applied to whole-of-government initiatives, including defense, safety and security, disaster management, and the protection of infrastructure and natural assets. Interests include information fusion, artificial intelligence, interoperability, modeling and simulation, and software engineering. Le Roux completed a Masters Degree in Computer Engineering at the University of Pretoria in 1999 with a focus on pattern recognition. He has also presented papers at various international conferences, published in local and international journals, and authored two book chapters.

Lebogang Mohubedu (previously Phahlamohlaka) is an information systems professional and a computer security enthusiast with over three years of experience in the ICT sector. She completed her Bachelor of Science in Computer Systems in June 2014 from Heriot Watt University. She was awarded a scholarship in 2014 by the Japan International Cooperation Agency to pursue her Master of Science at the Kobe Institute of Computing in Kobe, Japan. She completed her Masters in Information

Systems Security in September 2017. Before this, she volunteered at Seidet as part of the e-entrepreneurship program for marginalized entrepreneurs, assisting and conducting lectures in e-skills training. She became a Deputy Director in IT Document Management at the Commission of Inquiry into State Capture in Johannesburg, South Africa. Currently, she is looking into pursuing her PhD in Information Systems Security and also working and investing in her IT consultancy firm (Anzen).

Sydney Lefifi celebrates and embraces matters of beauty and coordinates all design responsibilities within the LEMEG Group. He studied architecture at the Tshwane University of Technology, specializing in design and attained his Master's Degree in the same field. In 2010 he received a diploma at the Marmomacc Stone Academy in Italy. In 2008 Sydney became a partner in LEMEG and shared design and management responsibilities. He has since matured into the partnership and helped to transform the practice into a major player in the industry. In 2011, having served two years on the management committee of the Limpopo Institute for Architecture, Sydney was elected President of the same institute and accomplished a successful two-year term. During the two years, the institute implemented a new brand and emphasized the development of youth by way of outreach programs aimed at schools.

Dr. Adriana A. (Riana) Steyn has been with the University of Pretoria (UP) for the last eleven years after she returned to academia from industry. She is currently a full-time senior lecturer in the Department of Informatics. Throughout the years, Riana has engaged numerous students by presenting both undergraduate and postgraduate modules. She has published various articles based on her teaching as well as entrepreneurial research experiences over the last few years. Her research focuses mainly on technology in education within the business analysis and design space, and how she can engage students more effectively while still delivering good quality content. Her different approach to teaching was born from the entrepreneurial research she is also passionate about. Here she developed a framework for SMEs to engage more effectively with technology as well as developing an "e-Skills for Entrepreneurs" course which focuses on effective technology engagement to create sustainable businesses. She won the International Association of Information Systems Award for Innovation in Teaching in 2018, and the UP Teaching Excellence Laureate in 2019.

Karabo Mokaba is a professional architect and registered with the South African Council for the Architectural Profession (SACAP). He was born in Johannesburg, Soweto. As an undergraduate at the University of Johannesburg, Karabo received numerous awards of excellence including the South African Institute of Steel Construction (SAISC) Prize for

Excellent Work based on steel construction and concrete, and the Cement Institute Award for Joint Best Fourth-Year Student in Construction and Detailing. In 2011, Karabo was awarded a National Research Foundation scholarship and graduated with a masters in architectural technology (professional) degree in March 2013. His thesis, titled *I2=Intermodal Interchange Information Exchange*, received the Corobik Architectural Student of the Year Award for the best use of masonry detailing. Karabo has worked for various firms where character growth is complemented by a strong emphasis and appreciation for design and detailing. He is highly enthusiastic about the design of systems.

Vusi Ndala is an accomplished and results-driven entrepreneur with expertise in strategic management, business turnarounds, revenue management, performance optimization, finance, sales and marketing, business and market development, risk management, and project management. He is an MBA graduate in global business and sustainability and holds a diploma in strategic management from the Maastricht School of Management in the Netherlands. He also holds a master's degree in philosophy specializing in labor relations management, obtained from the University of Pretoria. He founded Mzilakatha Strategic Management Services (renamed Ndalzen Group) headquartered in Johannesburg, South Africa in 2009 specializing in strategic management advisory and consulting. For over twenty-five years, he has dedicated a substantial amount of personal time to community service and development through various NGOs and professional organizations. He was and is still honored and privileged to be holding significant leadership roles in these organizations. He is an achiever of note. He has been awarded several accolades for meritorious service from both professional and community organizations. Chief among others are the Black Management Forum

(BMF) Gauteng Manager of the Year in 2006, Employee of the Year for two consecutive years in 2002 and 2003 from the Sowetan/Hollard Achievers Club, the UCSC International Scholarship Award, the Nuffic Scholarship Award, and the NRF Scholarship Award.

Carina de Villiers is a full professor and Head of the Department of Informatics at the University of Pretoria, South Africa. She obtained a BSc in computer science and mathematics, a higher education diploma, a diploma in tertiary education, an MEd (didactics) cum laude, an honors degree in computer science and a PhD in informatics). She is a member of several international bodies and serves on a number of editorial and advisory boards for journals, including IT and Development, and Information Systems Research. She has held a National Research Foundation rating as an established IS researcher since 2000.

Linda Malinga is a senior telecommunications engineer at the Council for Scientific and Industrial Research (CSIR) under the Integrated Capability Management research group, focusing on telecommunications, command and control, and intelligence systems. He joined the CSIR in 2008 as a researcher in the Mathematical and Computational Modeling Research Group where he was involved in modeling, simulation, and data communication systems. Linda authored and co-authored a number of international conference papers and book chapters in various fields

including modeling and simulation, crowd control modeling, next generation networks, and ICTs in society. Prior to joining the CSIR, he enjoyed software engineering, home automation, and network development projects in the private sector. He holds a bachelor of science degree in electrical and information engineering from the University of the Witwatersrand (2005, South Africa); a bachelor of engineering (honors) degree in electronic and electrical engineering from the University of Pretoria (2016, South Africa); and is currently pursuing a master's degree in technology and innovation management with the University of Pretoria.

Dr. Noluxolo Gcaza is passionate about making cybersecurity accessible to different contexts. Her research interests include cyber security governance, cybersecurity awareness, and education. Currently she is a Research Group Leader at the Council for Scientific and Industrial Research (CSIR). She serves on the Advisory Board of the Center for Research in Information and CyberSecurity (CRICS) at Nelson Mandela University. Dr. Gcaza also served as a Board Member in SaveTnet, a non-profit organization that focused on fostering a culture of cyber security in a community setting through spreading cyber security awareness. She contributes in the South African Bureau of Standards standardization process as a committee member of the Information Security Technical Committee.