REA NKHUMISE

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CAREER SUMMARY

- **Chief Technology Officer,** *Konvi (Pty) Ltd*., Cape Town, 2018 – Present.
- **Innovation Consultant/Project Manager,** *Planet Eye (Pty) Ltd*., 2016 – Present.
- **Commercialization Specialist/Project Manager,** *SARAO* (formerly *SKA*), Cape Town, 2018 – 2019.
- **Mechatronics/Systems Engineer,** *SARAO* (formerly *SKA*), Cape Town, 2016 – 2017.
- **Assistant Researcher,** *University of Johannesburg*, Johannesburg, 2014.
- **Earlier Experience: Junior Engineer,** *Denel Dynamics., Anglo American Thermal Coal.,*

PROFESSIONAL QUALIFICATIONS

System Engineering & Management, *International Council on Systems Engineering South Africa, ECSA Continuing Professional Development*, South Africa. 2017

Masters of Science in Engineering, Robotics Engineering, *Tennessee Technological University*, Cookeville, TN, United States. 2016

Bachelor of Science in Engineering, Mechanical Engineering, *University of the Witwatersrand*, Johannesburg. 2013

CAREER HIGHLIGHTS

Co-founder & Chief Technology Officer, *Konvi (Pty) Ltd.*

Technological company that integrates social lifestyle, culture and entertainment with technology to optimize event-based experiences. (Web: www.konvi.co)

Key Responsibilities:

- Devise technological strategies & oversee that they meet the company's business needs.
- Manage a team of developers as the product owner using agile management.
- Translate clients' needs into actionable technical requirements using systems thinking approach.
- Design detailed system architecture and oversee its production.

Key Achievements:

- Secured a R2.4 million investment in 2 years.
- Cut service fees by 50% (saving R250k) through negotiations and restructuring the contractors' workload by suggesting to perform analysis on their behalf so they can focus on development.
- Performed extensive market research & consumer-need analysis to improve the UI/UX design of the product which improved customer reception by 80%.
- Improved a fairly functional website into an impressive one (in 2 weeks) that enhanced client engagement by ~60%.
- Devised a successful marketing plan which reduced costs by a factor of ~60% for the introduction of a new product into a highly competitive market.
- Developed a fully functional app, and acquired more than 3,000 users in 25 days. Currently the app awaits for commercialization.

Innovation Consultant/Project Manager, *Planet Eye (Pty) Ltd*.

My freelancing technological company that offers services in consultation and design for innovation models and digital systems.

Key Responsibilities:

- Provide advice, recommendations, and guidance on IT, VR, robotics technologies, services & systems.
- Integrate new mechatronic solutions to improve process efficiencies.
- Assess and examine IT or engineering needs and requirements for clients.
- Perform mechanical and robotics system designs for clients.

Key Achievements:

- Helped close a client's first virtual reality project contract (of R300k) by leading the company's new VR department.
- Designed & developed a proprietary kitchen device (patent pending) that is used for cooking purposes which reduces energy consumption by 40% and cooking time by 50%.
- Consulted for a client's project in education app development which ended up receiving funding of more than R100k.

Commercialization Specialist/Project Manager, *SARAO* (formerly *SKA*).

World scientific consortium project that is building the largest and most sensitive *radio telescope* in the world. (Web: www.ska.ac.za). Functioned at the *Commercialization Department*.

Key Responsibilities:

- Evaluate and devise market-needs, product value-proposition, and business development strategies.
- Head research and development of the new technologies.
- Provide technical support to engineering teams in meeting user-requirements.
- Project manage 3 – 4 engineering projects in electronics, robotics, and software development.

Key Achievements:

- Assisted in the commercialization of products which landed a deal worth more than R1 million.
- Influenced and inspired employees to participate in the commercialization program with poor initial participation of about 3, to a significant 600% in 1 – 2 months.
- Represented about 20 trainees to management in a conflict resolution with seniors of which the outcome was improved program efficiency (by 20%) and cost-saving (by 50%) to the company.

Robotics/Systems Engineer, *SARAO* (formerly *SKA*).

World scientific consortium project that is building the largest and most sensitive *radio telescope* in the world. (Web: www.ska.ac.za). Functioned at the *Science Data Processing Department*.

Key Responsibilities:

- Design of a pressure-vessel heat-exchange unit that absorbs heat generated and dispose it into the environment (called IronHive).
- Design of a robotic system that autonomously pick tapes from storage a unit and insert into a tape reader at the user's command (called Tape Library).
- Perform system documentation, BOM, and workshop fabrication.

- Perform system analysis, derive system requirements, and apply system engineering methodology in design.

Key Achievements:

- Took over the Tape Library project from idea stagnation (with zero progress) to a working tertiary prototype in 11 months.
- Managed and engineered 2 highly complex innovative products in 2 years of which can potentially prevent R4 million in license fees.
- Conferred a Systems Engineer of the Year award for leading the team in solving a socioeconomic issue using systems engineering methodologies.

Earlier Experiences:

Assistant Researcher, Department of Computational Intelligence, *University of Johannesburg.*

- Researched & developed techniques for applying Artificial intelligence in Finite-Element Analysis.

Junior Engineer (Internship), Department of Mechanical Engineering, *Denel Dynamics.*

- Designed and developed test rig for system characterization of radio controlled servomotors in aerospace machinery.

Junior Engineer (Internship), Mining Industry, *Anglo American Thermal Coal.*

- Performed root cause analysis on the plant's screen bowl centrifuges and mineral crusher, then developed systematic procedures to maintain the machines in operation.
- Performed root cause analysis on the mine's heavy-duty hydraulic shovel called RH200 excavator, then then developed systematic procedures to maintain the machine in operation.

TECHNICAL COMPETENCY

- Project Management, project planning, agile management, team management, systems engineering.
- System architecture, characterization, analysis, root-cause analysis.
- Business acumen, analysis, Business development. Business improvement.
- Marketing management, marketing research, marketing analysis, Operation management, strategic planning.
- Business plan design, investment portfolio design, fundraising, process optimization.
- Model Based Systems Engineering (MBSE), Data modelling, Mathematical modelling.
- Autodesk Inventor, AutoCAD, ANSYS-FEA, MATLAB/Simulink,
- Python, C++, HTML, CSS, JavaScript, MATLAB.
- Control/Embedded Systems with Arduino, Raspberry Pi, Dragon-12, PLC.
- UI/UX design, Application architecture, web development, e-commerce development, Photoshop, Virtual-Reality architecture.
- Sensor integration, 3D printing, rapid-prototyping.
- ERP – Enterprise resource planning, MS Office, Google Analytics, G-Suite.

TRAINING & WORKSHOPS ATTENDED

- **Advanced Python Programming,** *Leading Edge*, Cape Town.
- **Entrepreneurship & Innovation,** *NSF Lean Launchpad Program*, Cookeville, TN, U.S.
- **Business Management,** *Tennessee SBDC*, Cookeville, TN, U.S.
- **Marketing Management,** *College of Business – Tennessee Tech University*, Cookeville, TN, U.S.

PUBLICATIONS

Khalo, M. G. & **Nkhumise, R. M.** (2018). "Big Data Analytics: Saving Small Businesses in Entertainment and Hospitality," *International Journal of Management and Commerce Innovation.* {Published}

Canfield, S. L. & **Nkhumise, R. M.** (2017). "Controllability Ellipse to Evaluate Performance of Mobile Manipulators for Manufacturing Tasks," *Journal of Mechanisms and Robotics*. {Published}

Nkhumise, R. M. (Eds.) (2014). "Artificial Intelligence Techniques for Rational Decision Making." By Marwala, T. *Springer*, ISSN 1610-3947. My research encompassed investigating the application of computational intelligence in improving Finite-Element Analysis (FEA) for structural design. {Published}

DISSERTATIONS

Nkhumise, R. M. (2016). "Controllability Ellipsoid: A Method to Evaluate the Performance of Mobile Manipulators." Master's degree Thesis, *Tennessee Technological University*. {Supervisor: Dr. Steven Canfield}. I was investigating novel techniques for evaluating control design performance of robots. The aim was to devise mathematical models that describe task requirements for robots and their capabilities in n-dimensional tool space. The significance of the research was to quantify task performance, and devise an effective comparison method for performance of control techniques designed for robots executing the same task.

Nkhumise, R. M. (2013). "Modeling, Identification & Feedback Linearization Control of a Multivariable Hydraulic Servo System." Undergraduate Senior Year Research Project, *University of the Witwatersrand*. {Supervisor: Dr. Jimoh Pedro}. I performed system characterization, devised a mathematical model for hydraulic excavators, and developed an artificial intelligence program using neural network techniques to utterly automate operations of the excavators.

Nkhumise, R. M. (2013). "Mechanical Actuation System for a Wave Source Linear Energy Generator." Undergraduate Senior Year Design Project, *University of the Witwatersrand*. {Supervisor: Dr. Edward Moss}. I designed a system that harvests energy from ocean waves and converts it into electricity. Furthermore, I developed the system's control algorithm using MATLAB/Simulink.

CONFERENCE PRESENTATIONS

Nkhumise, R. M. (2018). "Low Cost Robotic Tape Library Systems Using Open Source Technology." [PowerPoint presentation]. Presented at the *4th World Congress on Robotics & Artificial Intelligence* (in Osaka, Japan) and *AfricaOSH Summit for Open Science & Hardware* (in Kumasi, Ghana). The work was done at *Square Kilometer Array* for the Department of Science Data Processing. It entailed design and development of robotic tape library systems for large cold big data storage. {Online}

Nkhumise, R. M. (2018). "IronHive: Server Immersion Cooling System." [PowerPoint presentation]. Presented at the *Square Kilometer Array Young Professionals Program Conference.* The work was for the Department of Science Data Processing. It entailed investigation, design and development of immersion cooling systems for high computing servers.

Ngoetjana, M.; Nhlapo, T. & **Nkhumise, R. M.** (2017). "Alleviating Malnutrition in Impoverished Communities Using System Engineering Approach." [PowerPoint presentation]. Presented at the *13th Annual International Council on Systems Engineering South Africa Conference.* The project was about finding sustainable ways to assuage poverty at local impoverished communities using system engineering approach.

Nkhumise, R. M. (2014). "Radio Controlled Servo Characterization in Aerospace Machinery." [PowerPoint presentation]. Presented at the *Denel Dynamics Bursary Conference.* I developed a test rig facility to perform system characterization of radio controlled servomotors in aerospace missiles.

Nkhumise, R. M. (2013). "Root Cause Analysis of Screen Bowl Centrifuges & Mineral Crusher." [PowerPoint presentation]. Presented at the *Anglo American Thermal Coal Bursary Conference*. I conducted system analysis and fault identification, and finally developed a solution to eliminate the fault.

Nkhumise, R. M. (2012). "Root Cause Analysis of Heavy-Duty Mining Shovel RH200 Hydraulic Excavator." [PowerPoint presentation]. Presented at the *Anglo American Thermal Coal Bursary Conference*. I piloted a system analysis and fault identification process, and subsequently devised a solution to remedy the fault.

PROJECTS AND PATENTS

Nkhumise, R. M. (2019). "Virtual Reality (VR) System Game for Showcasing Commercial Products." [VR App]. Project under *Planet Eye (Pty) Ltd*. I researched, with intent to develop, the most effective use of Virtual Reality by commercial retailers. Though the VR market is growing, many industries have not found a way to use it meaningfully. I designed the VR game for retailers to showcase their commercial products to prospects. I served as the project's manager and game architecture.

Khalo, M. G. & **Nkhumise, R. M.** (2019). "Method and system for creating and publishing an event on a platform." CIPC No.ZA 2019/06503, 03 October 2019. [Patent]. I conducted a study about improving the process of finding favorable vibes for partying among young people. This included reducing the effort, complexity, time-consumption, and risk of determining the most favorable going-out experience at an instance. Furthermore, part of the research outcomes was improving the access of businesses (selling fun and organizing parties) to suitable patrons at reduced effort, time, and costs. Young people are the most active age group in attending parties, and many businesses in the entertainment industry want to attract them. However, the conventional process of bringing these two groups together can be significantly improved. As a result, I introduced 'an on-demand going-out marketplace mobile app' called *Konvi,* to address challenges experienced by both groups.

Nkhumise, R. M. (2018). "Automatic Pap (Porridge) Cooker: Rehydration system for preparing maize-based meals." CIPC No. ZA 2017/34494, 09 December 2018. [Patent]. I investigated a novel way of preparing South Africa's indigenous staple meal: *Pap*. The meal is a cultural symbol which over 46% of

South African households consume daily. For generations, it had been prepared manually using spoons and pots – a process that is a strenuous, complicated, time-consuming, and potentially hazardous. Culturally, a woman's ability to cook *Pap* is associated with her value in marriage, and the notion forces females to learn to prepare *Pap* from the ages of twelve until marriage. The outcome of my research was an invention of an autonomous device.

Alharbi, N.; Normand, E.; **Nkhumise, R. M.** & Stephenson, C. (2016) "Miniature fan-based refrigeration system for confined environments." U.S. Patent Application No. 62/316250, 31 March 2016. [Patent]. During my Master's degree, I participated in a project whose objective was to address safety concerns of parked vehicle with heat-buildup on sunny summer days. Unfortunately, there are accidental deaths annually of children and/or pets left unattended in vehicles with windows closed. We invented a fan-based miniature refrigeration system which can absorb the heat building up in the vehicle and dissipate it to the environment – without having to open the windows.

HONORS AND AWARDS

Sharpest Systems Engineer, *INCOSE South Africa*	2017
Most Innovative Project Award, *Tennessee Tech University, Eagleworks, U.S*	2016
Certificate of Merit for the course Mathematical Methods	2013
Knockando Residence Honor Student, *University of the Witwatersrand*	2012
Certificate of Merit for the course Mathematics II	2012
Certificate of Merit for the course Material Sciences & Engineering	2012
Dean's List, *University of the Witwatersrand*	2011, 2012
Golden Eye Honorary	2011
Knockando Residence Honor Student, *University of the Witwatersrand*	2011, 2012
Certificate of Merit for the course Mathematics I	2011
Certificate of Merit for the course Mechanics	2011
Certificate of Merit for the course Physics I	2011
Certificate of Merit for the course Chemistry I	2011
Valedictorian of 2009 Class, *Tsogo High School*	2009
Graduated high school with 'distinction'	2009
SRC Matric Project Honor Student, *University of Limpopo*	2008, 2009
Eskom Science Expo Silver Award, Regional Finals	2006, 2009

SCHOLARSHIPS AWARDED

Fulbright Scholarship, U.S.	2014 - 2016
American Society of Mechanical Engineers Auxiliary Scholarship	2014
University Council Merit Scholarship	2012
University Council Merit Scholarship	2011
National Research Foundation SKA SA Scholarship	2010 - 2013
University Entrance Scholarship	2010
University Council Merit Scholarship	2010

UNIVERSITY AND COMMUNITY SERVICE

International Student Exchange Program Chairperson **Jan/2014 – Aug/2014**

IGRISE, Pretoria, South Africa

I served as the chairperson of the student exchange program for high school students. The program selects high performing students and takes them internationally for a period of 1 – 3 months, to 1) learn about careers in their prospective professions, 2) learn about other cultures, and 3) receive leadership training at an early age. The participating countries including United States, United Kingdom, and Australia.

Tutoring Program Member **Jan/2014 – Aug/2014**

SRC Matric Project, University of Limpopo, South Africa

I was tutoring mathematics and physics to grade 10 and 12 high school students, at a Saturday school. My responsibilities included giving lessons, setting assignments, and helping students understand the subjects.

Tutor **2013, 2014**

Mechanical Engineering Departments, University of the Witwatersrand and University of Johannesburg, South Africa

I was a tutor in 2013 at the first mentioned institute, and 2014 at the later. In 2013, I tutored mechanical engineering design to sophomores. In 2014, I tutored thermodynamics and mechanical engineering laboratory course to seniors. My responsibilities included facilitating and marking tutorials.

House Committee Chief Electoral Officer **2013**

Knockando Residence Hall, University of the Witwatersrand, South Africa

I supervised the elections of the 2014 House Committee. My responsibilities included facilitating and organizing election rallies.

House Committee Secretary **2013**

Knockando Residence Hall, University of the Witwatersrand, South Africa

I was responsible for organizing Committee and residence meetings. I facilitated communication among members. I supervised the process of designing and developing residence jackets.

Youth Development Program Chairperson **2012 – 2013**

Clear Fear, Pretoria, South Africa

I co-founded the program with the aim of inspiring young people in my community to be high achievers, and set goals to meaningfully contribute to society. My responsibilities included being a motivational speaker, organizing mathematics, science, and programming classes for high school students.

Church Building Committee Member **2008 – 2009**

St. Mark Catholic Church, Pretoria, South Africa

I served on the committee to represent the interests of youth in the project of building a new church.

Art Club Executive Member **2006 – 2007**

Tsogo High School, Mmakau, South Africa

I facilitated the acquisition of art equipment for classes. I was the class assistant and helped other members with learning art techniques.

Student Representative Council **2005, 2006 & 2009**

Tsogo High School, Mmakau, South Africa

I represented my class in the council. The council organized special-activity days at school like Sports and Fun days. We liaised with teachers and other stuff members to represent the interests of students.

ACADEMIC AND PROFESSIONAL AFFILIATIONS

Southern African Neuroscience Society (SANS), member (2019 – present)

International Council on Systems Engineering South Africa (INCOSE SA), member (2017)

American Society of Mechanical Engineers (ASME), member (2016)

Society of Women Engineers, member (2015 – 2016)

African Student Union Society, member (2014 – 2016)

Tennessee Tech University Formula SAE, member (2014 – 2015)

South African Young Academy of Science (SAYAS), member (2013 – 2014)

University of Witwatersrand Alumni, member (2013 – present)

International Golden Key Honorary Society, member (2010 – present)

CONFERENCES ATTENDED

Innovation Bridge Event and Science Forum South Africa 2019, CSIR International Convention Centre, Pretoria, 4 - 6 December 2019. Representing innovations in ICT on behalf of *Konvi (Pty) Ltd.*

ITU Telecom World 2018, Durban South Africa, 10 – 13 September 2018. Presenting VR technology.

AfricaOSH Summit for Open Science & Hardware, Kumasi Ghana, 12 – 15 April 2018. Presenting the Tape Library System.

4th World Congress on Robotics & Artificial Intelligence, Osaka Japan, 23 -24 October 2017. Presenting the Tape Library System.

14th ANNUAL INCOSE SA CONFERENCE, CSIR International Convention Centre, Pretoria, 3 - 5 October 2018.

13th ANNUAL INCOSE SA CONFERENCE, CSIR International Convention Centre, Pretoria, 11 - 13 October 2017. Presenting the project titled "Alleviating malnutrition in impoverished communities using system engineering approach."

Science Forum South Africa 2016, CSIR International Convention Centre, Pretoria, 9 December 2016. Panelist on discussion about Knowledge Economy.

Fulbright Enrichment Seminar, *Entrepreneurship & Technological Innovation*, Pittsburgh, U.S., 2015

U.S. President Obama's Town Hall with Young African Leaders, University of Johannesburg, 2013. Nominated for showing leadership and interest in community development in South Africa.

REFERENCES

Provided on Request.