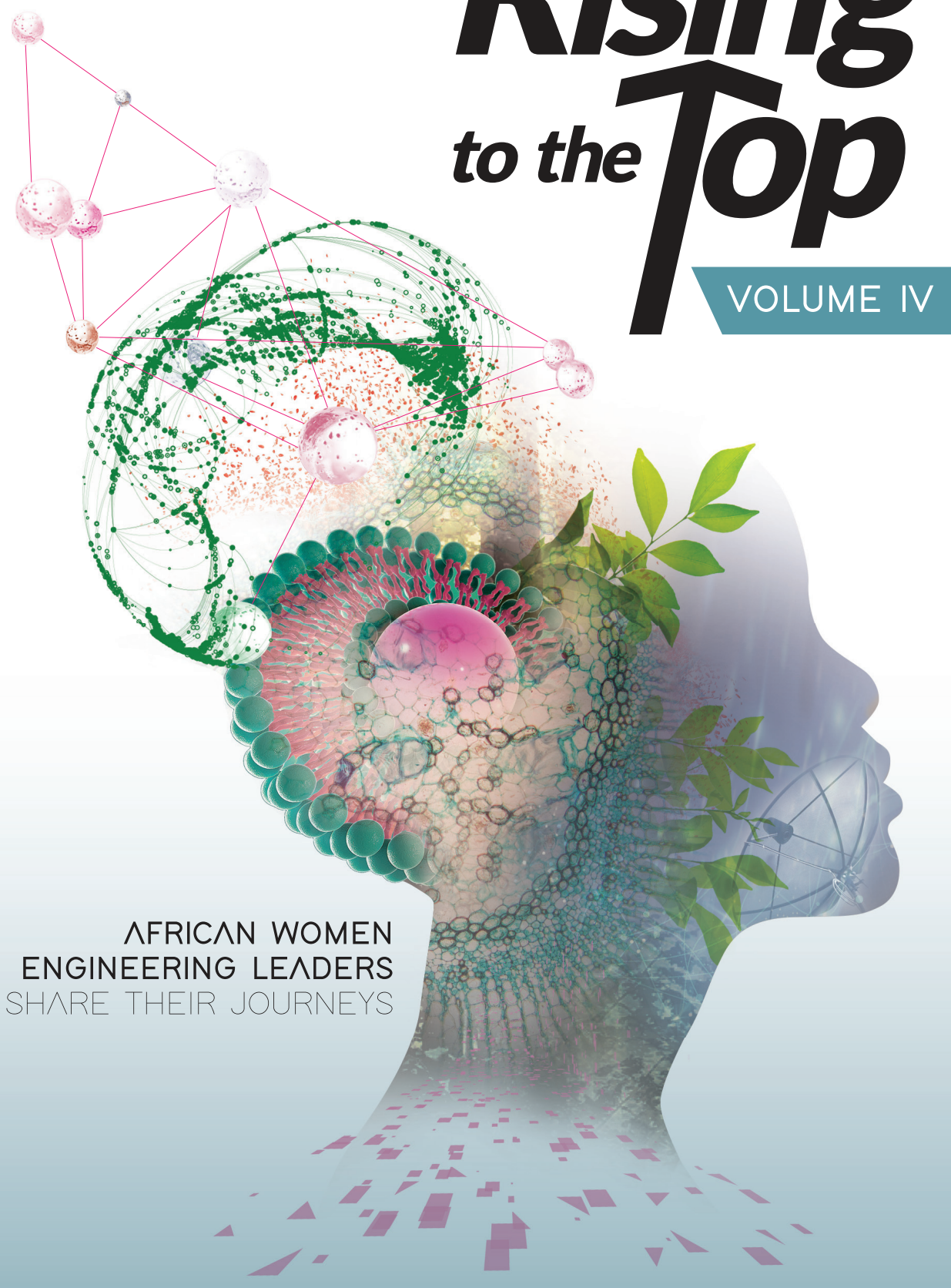


Rising to the Top

VOLUME IV



AFRICAN WOMEN
ENGINEERING LEADERS
SHARE THEIR JOURNEYS

RISING TO THE TOP

AFRICAN WOMEN ENGINEERING
LEADERS SHARE THEIR JOURNEYS TO
PROFESSIONAL SUCCESS

VOLUME IV

-

INTERNATIONAL FEDERATION OF
ENGINEERING EDUCATION SOCIETIES
&
GLOBAL ENGINEERING DEANS COUNCIL



**International Federation of
Engineering Education Societies**



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COORDINATING COMMITTEE

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Hans Jürgen Hoyer

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INTRODUCTION

BOOK SPONSOR

NIHAT BAYIZ

Chief Technology Officer, *Arçelik*



Diversity is one of the key drivers behind creating innovative solutions to problems, and instrumental in designing products and services with superb customer value. Fostering female leadership roles in engineering should be the first step for executives in the corporate world as well as in academia. It is key in building an encompassing culture that enables different perspectives to be reflected in the workforce.

While more women are entering STEM (science, technology, engineering and maths) occupations, the majority are going into life sciences, where the gender gap is now almost closed. In order to boost the number of women pursuing engineering careers, we need the kind of powerful and outstanding role models who share their stories in this book.

As you read these inspiring journeys, I am sure you will share my thoughts on how engineering can be both exciting and rewarding, especially when executed with the conscience, passion and perseverance of exceptional African female engineers.

I hope this book will motivate young people who are interested in science and engineering to pursue careers in the field for better tomorrows for all

humanity. As one of the most famous engineers in history, Leonardo da Vinci, succinctly observed: “I have been impressed with the urgency share the successes and challenges of providing world-class engineering education programmes in an increasingly interconnected and fast-paced world

of doing. Knowing is not enough; we must apply. Being willing is not enough; we must do.”

A heartfelt thank you to all 30 of our contributors for doing and rising. By rising, you will help raise others up too. This is a great legacy to foster. We salute you.

A SPECIAL THANK YOU TO ARÇELİK,
WHOSE GENEROUS SUPPORT HAS
HELPED MAKE THIS BOOK POSSIBLE

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INTRODUCTION

COORDINATING COMMITTEE MEMBER

TAGWA MUSA

**GEDC Member and Associate Professor of Petroleum
Engineering at the *Sudan University of Science and Technology***

Back in 2018, when Professor Hans Hoyer, General Secretary of the International Federation of Engineering Education Societies (IFEES) and Executive Secretary of the Global Engineering Deans Council (GEDC), first asked me to write a piece about my journey in academia as a dean of engineering in Sudan, I never expected or imagined it would lead to the entire Rising to the Top series in which 54 women engineering leaders around the globe shared their journeys to professional success in Volumes 1 and 2. And yet, here we are now, publishing the fourth volume in this important series!

In Africa we often quote the well-known saying that it takes a village to raise a child. We know that any great undertaking requires a group of individuals who are collectively committed to a greater good and working together to bring it to fruition. Indeed, if we view this fourth instalment of the IFEES/GEDC Rising to the Top series, which represents female engineering leaders from across our beloved continent, as our collective child, this has certainly proven to be true!

From Morocco and Egypt in the north to South Africa in the south and from Ethiopia in the east to Nigeria and Senegal in the west, 30 engineering leaders from 28 African countries represent a diverse group of talented individuals who

have worked with dedication, perseverance, passion, patience and enthusiasm to sensitively construct this engaging volume of inspiring journeys.

Together we have conceived of, grown, developed, carried and birthed this wonderful collection of important and inspiring stories. In some ways, it has also been ‘engineered’ through design, innovation and the many creative minds that have contributed to it – a fitting metaphor given its subject matter.

I am so grateful to everyone who has been part of this incredible project. It has been my honour to have led it on behalf of my African sisters, thanks to the support of my dear friend and colleague Professor Hans Hoyer. Thanks to him, I have had the privilege of heading our coordinating committee, a task that has delighted me.

This endeavour is close to my heart, as casting a spotlight on the inspirational lives and incredible work of Africa’s female engineering leaders remains vitally important. It acknowledges these leaders as pioneers and trendsetters who break down gender stereotypes in often traditionalist, male-dominated societies, but will also actively encourage others, especially young girls and women, to join the STEM (science, technology, engineering and mathematics) field, and specifically the engineering sector, knowing that it can be done, and with style, grace and flair, as our writers display.

We hope you find these interviews, memoirs and third-person biographies insightful, entertaining, moving and powerful. I am so proud of the courage of each of our 30 contributors, representing a snapshot from across the African continent and sharing their challenges, successes and insights.

I would like to thank our sponsors: Arçelik, UNITAR, ABET, Quanser, Huawei, Consulting Technologies Information (CTI), Morgan State University,

Pontificia Universidad Católica de Chile, USC Viterbi, and Indiana State University. I would also like to thank Dawn Bonfield and the Women in Engineering Committee - Federation of African Engineering Organizations (FAEO) for their help during the co-authors selection stage.

I am extremely grateful to our coordinating committee: Soma Chakrabarti, Theresa Mkandawire, Debby Blaine, Valerie Agbera and Hans Jürgen Hoyer, without whom this could not have been achieved.

A special word of thanks to the IFEEES and GEDC Secretariat staff, the incredible international communications manager, Aliko Pappas, and the international programmes associate, Salma Wahba, who worked tirelessly and with the utmost professionalism to help us reach our goal.

Our patient and supportive project coordinator, Laura London (who kept all our disparate strings together) must also be acknowledged for remaining the voice of reason and inspiration throughout the time it has taken to reach our final publication date.

And last but not least, I wish to express gratitude to our comprehensive Cape Town-based editorial team led and managed by Kayang Gagiano and comprised of story editors Elizabeth de Villiers, Tascha Gagiano, Janey Gagiano, Maureen Miller and Kylie Quinn, as well as copy editor Amelia Burger of Lemonade Hub and Danie de Villiers of G Studio Branding Agency who designed our engaging cover.

Now I encourage you to sit down and start reading – there is much to learn and be inspired by in these pages.

Sincerely,

Dr Tagwa Musa

MEMOIRS

01. Ask Amel: she knows, because she learnt!

Amel Chenouf // Algeria

02. Changing the narrative on a woman's potential

Miriam Modong Dangasuk // South Sudan

03. Educate a woman, educate a nation

Loice Gudukeya // Zimbabwe

04. Cool operator

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09. Paving the way forward: moving up and reaching out

Widad Yagoub Ibrahim Osman // Sudan

10. Fortune favours the brave

Cecile Uwimana // Rwanda

JOURNEY 1

**ASK AMEL: SHE KNOWS,
BECAUSE SHE LEARNT!**

Amel Chenouf

*Researcher at the Centre for the Development
of Advanced Technologies (CDTA)*

ALGERIA

From TV kid to top scientist

It's fascinating how many seemingly insignificant memories and small details can take one back to childhood. I was asked why I chose the STEM field in a talk I gave to students in the University Saad Dahleb of Blida (USDB), in 2019 to celebrate the International Day of Women and Girls in Science.

Why did I get into the STEM field? It's a good question, with a surprising answer. It took me back to my infancy, when I fell in love for the first time. In love, that is, with science and technology — and this was through

cartoon characters named Labiba and Sami!

Does this surprise you? Okay! Let me share with you my story from

ABOUT THE AUTHOR



Dr Amel Chenouf is a researcher at the Centre for the Development of Advanced Technologies (CDTA), an R&D (research and development) centre in Algiers, Algeria. She has a PhD in microelectronics and extensive experience in the physical design of integrated circuits. She joined the CDTA's microelectronics & nanotechnology division in 2005. Since then, she has worked for different research groups on R&D projects, such as CAD tools development for low-power design, Cadence process design kit development for the CDTA's technology process and semiconductor devices characterisation & IC reliability. She currently leads a group working on the latter R&D project.

Amel has contributed as author and co-author in several published scientific papers. She has also served as a reviewer for scientific journals and conferences in the microelectronics field. Besides research, Amel has tutored students in electronics engineering, volunteered at IEEE conferences and served as a coach in startup weekend events in Algeria.

She is a member of both the Institute of Electrical and Electronics Engineers (IEEE) and IEEE Women in Engineering. She is a member of DZ Women in Technology and the TW-TG DZ Club, aimed at empowering women in science, technology, engineering and mathematics (STEM).

Amel has also served as the publication chair for the International Design and Test (IDT) Symposium for three years. In 2014, she received a certificate of appreciation from the Test Technology Technical Council (TTTC) for providing outstanding student volunteering services for the IEEE International Design and Test Symposium. She is an alumna of TechWomen, a project-based mentorship at leading companies in California's Silicon Valley and the San Francisco Bay area in the USA.

In 2015, she was nominated as one of the 54 Notable Women in Technology in the Middle East and Africa and included among the emerging leaders of the TechWomen programme between 2011 and 2014.

watching a TV series to working as a scientist at one of the main R&D centres in my country, Algeria.

Growing up after war

I was born in Ras El Oued, a small town about 300km from Algiers, the capital of Algeria. A decade after Algeria became independent, most parents were still not educated, due to difficult circumstances during the French occupation, followed by the seven-year liberation war.

The decision-makers in Algeria were aware of the societal situation and made education compulsory for children between six and 16 years, and it was free of charge. At my primary school I learnt Arabic and maths, and from the third year we also took French as the first studied foreign language.

I was outstanding at school, I learnt fast and asked questions to know more. I understood the courses and did my homework without receiving any help from my siblings. But I was still a child; after school, I enjoyed going outside to play hopscotch and jump rope with my cousins and neighbours.

Ask Labiba – and Sami!

In middle school, we started to study science, physics, history, geography and English as the second studied foreign language. I still watched TV at home, and one particular programme captured my full attention, to the point where I would not miss a single episode. It was called Ask Labiba, an educational animated series that explored and explained famous scientific discoveries.

The love of science took hold of me then, making me curious and eager to learn. Labiba also means “smart” in Arabic, so it was like a sign – a clever, inquisitive and talented girl can succeed through commitment and perseverance, was the message that landed with me. I was hooked.

Then came Sami, a do-it-yourself specialist who provided answers to the questions about how things work. Sami’s Science Lab quickly became my second favourite educational programme.

I knew then that I would one day enter the STEM field.

Standing out and standing strong

At secondary school, subjects became more complex and the competition between students was intense. Students with high grades were orientated to STEM branches and the best of them to study maths. I think girls made up about 40% of the class.

After the first year, and because of the competition between us, some of my classmates stopped talking to me. I realised that they behaved in such a way because they were somehow jealous of me, as I was ahead of them in maths and physics.

This did not upset me until some girls started avoiding me, as I did not share interests like fashion and makeup with them. As a result, I found myself sitting alone at the table closest to the board for about two years. Fortunately, I still had friends from other classes. It was tough to be ostracised by some, but I was undeterred and continued to do my best.

Choices, choices ...

The third year at secondary school in Algeria is completed by passing a national exam, the baccalaureate, to enter university. I passed it without any difficulty, which delighted my parents. The first step to enrol at the university was to fill out an application form showing our preferences of study. It was not easy to make up my mind –on the one hand I wanted to continue studying maths and physics; on the other hand, I did not want to upset my mother, who wanted to see me as a doctor, even though my older brother was about to finalise his medical studies (so we already had a doctor coming to the family).

I could not imagine myself memorising all the lectures, so I was relieved when I was orientated towards science and technology instead of medical science.

The start of university was challenging, to say the least. Sharing a room with someone I did not know, getting used to the noise from neighbours, arriving early at the lecture hall to claim a place where I could see the board and hear the lecturer all became manageable after a while, but were difficult initially.

Also, I had left home for the first time, and was 55km away from my family. Thanks to my brother who gave me a ride (for 18 months), I could go home every weekend, but some of the women had to stay on campus for two to three weeks without seeing their families. I felt for them and

knew how homesick they were.

After passing the second year of the common core of the engineering curriculum, we had to choose which of the focused fields we would follow. I hesitated between chemistry and electrical engineering and electronics, but eventually chose to enrol in the latter.

Politics interfere and passion wanes

That academic year coincided with the second round of the multiparty elections in Algeria and the forced resignation of our then-president, and the country went through difficult circumstances. Most students did not agree with the political decisions, so embarked on a long-term strike to claim people's rights in democracy. It lasted two months, during which we refused to attend classes.

It felt like the right thing to do at the time, but it upset my family, to whom it made me seem like an academic failure when I did not pass my final exams. For the first time I had become swept up by something other than science, and became less focused on studies, and I consequently failed my first year in electrical and electronic engineering.

It was a huge shock for my family; they had never imagined I could fail at anything! I redid the academic year and passed it, but something was fading in me: the eagerness to excel. This lack of enthusiasm lasted about two years. I regained a true passion for learning only in my final graduation year and luckily saw my parents happy again.

What being a woman in STEM feels like (to me)

I don't remember being discriminated against as a female student. Our teachers treated us equally and encouraged us to work on projects in mixed groups. This was not popular with recruiters; in fact, as women represent a third of graduated students in electrical and electronic engineering, the probability of finding a job is half that of a man.

Besides that, most engineering jobs are full-time in industrial districts, which are far from downtown. Lack of facilities meant that women struggled to continue working there, especially when they were married and had kids. These are among the reasons why girls and women avoid enrolling in electrical and electronics engineering, compared to fields like chemistry and biology.

Marriage? Or not ...

During my engineering studies I received some marriage proposals, but at that time it was difficult to get married while studying. I saw some female students who got married struggling to manage time and balance their studies and personal life, and quite often they gave up their studies. Although all parents, including mine, wanted to see their daughters eventually get married, my parents would not force me to do anything against my will. They just gave me advice, as they were more experienced than I was. When I thought about it, I decided to focus on my studies and think about marriage after graduation, if I met the right person.

After graduation, I applied for my master's degree, as I was more interested in pursuing postgraduation studies and carrying out research than in looking for a job. Unfortunately, I was not well-prepared for the exam due to the short time between graduation and the exam date (less than a month), so I failed it. The following year, I tried again, but also failed again. I was becoming familiar with failure.

A year later, I reapplied for the postgraduate course, and I finally passed the admittance exam. Among the 15 people who passed the exam, three were women. We studied a particular branch of electronics in three separate groups of five people each. Surprisingly, at the end of the academic year we realised that the three of us had each excelled in her branch – Tamame, Fouzia and I majored in automation, telecommunications, and microelectronics respectively.

I became a microelectronics whiz! Ask Amel – she knows!

An important note about failure

I am very open about my failures and have no shame around them. Failure is part of life and part of how we learn and improve ourselves. It happens to everyone, in some way or another. This is an important lesson. Your turn comes and you should be equipped to accept it. If you're not, you will learn how to cope with it, as it is inevitable.

My first lesson to share is that it's okay to fail. Give yourself permission. It's harder for those who always excel. One day, when they are not the first

or the best, the suffering is so much worse. We need to learn to accept that there can and will sometimes be someone better or stronger than ourselves in some area of life. No big deal.

My second lesson to share is that after a failure, get up fast and get back at it. Don't get stuck in that place of misery that has taken your self-confidence. Rebuild and continue.

My third lesson is, wear your failure as a badge of honour, because failure actually teaches you how to truly succeed.

A good example is the first research paper I submitted as part of my PhD studies in 2016 – it was rejected for publication. So, what did I do? I did not cry and accept the rejection. Instead, I rewrote it and after three long months of toil, I resubmitted it to the same journal, who then accepted it without any changes.

I started my PhD fairly late, at the age of 44, and it took me six years to complete. I did so in 2021, at the age of 49. So, you see? It is never too late to achieve your dreams. Keep chasing them.

That is the lesson right there – we must persevere. It is the only way. Face challenges and solve problems. This is the way of the engineering life, after all.

Research calling

For my master's, I worked for three years on a research topic related to testing integrated circuits, jointly supervised by a teacher at Setif

University in Algeria and an Algerian teacher at Grenoble INP in France. In September 2004, I defended my thesis and received my MPhil degree in microelectronics. The qualification opened doors for me to chase my dream, which was becoming a researcher.

The president of the selection jury suggested that I look at doing a PhD in the microelectronics division at the CDTA, an R&D centre in Algiers. A new chapter of my life was about to start.

Working woman and a PhD dream put aside

I was excited to reach out to the head of the microelectronics division. He asked me to send him a copy of my CV, my MPhil degree and thesis; a few days later, he called me back and told me my curriculum was interesting and invited me to visit the CDTA.

After a discussion with him and the head of a research group in the microelectronics division, he proposed that I join the CDTA as a research attaché. I was amazed – although I was looking for a PhD dissertation, I got a job offer! I was thrilled to accept, but first had to deal with an issue. Accepting the offer meant I had to move to the capital, and I was not confident that my family would accept this, especially as I had no idea where to live there.

My father was not okay with my move to Algiers as a woman by myself, but accepted it when my brother arranged my departure and accommodation with one of my cousins. I finally joined the CDTA in February 2005 and

was hosted by my cousin's family for more than seven months until I got accommodation the CDTA provided.

The demands of my job meant that I only started my doctoral studies in 2015. But it's okay. It all worked out the way it was supposed to. And today, I am indeed Dr Chenouf!

Equal pay but low representation

Even given equal pay for equal jobs, the ratio of women working as researchers in the CDTA's microelectronics and nanotechnology division has never reached 40%, and division and team head positions occupied by women are usually fewer than a quarter. Some women do not accept leading positions, and others leave the centre for the university, to spend more time with their children.

This is a sad reality and something I wish I could change.

Gender equality

Dealing mainly with men has been the norm during my CDTA employment; for the biggest part of 16 years I have been the only woman on the team. It happened only once that I had to face a critical situation because I am a woman.

As head of a working group I had allocated a task to a man, which he refused to do, feeling that he should be the group leader. He started to shout; I ended the meeting and reported the incident to my superiors. We held the meeting again and I invited one of our superiors to attend.

In the presence of the supervisor, he did not say a word about the task allocated to him. I realised that he simply refused to be led by a woman. Fortunately, this happened just once, and at the beginning of my career. For the most part, I am treated with deference and respect.

When I worked as the only woman on ICCAD (computer-aided design of integrated circuits) project, my two colleagues and I acted as a team. They taught me UNIX, coding and optimisation techniques, while I could teach them more about semiconductors and integrated circuit design techniques – it was a win-win collaboration.

In my current team, which I joined nine years ago as the only woman, my physicist colleagues deal with the reliability of semiconductor devices. while I attend to circuits built on these devices. Another woman recently joined our team and we exchange ideas, share knowledge and work together to solve research problems. After all, solving problems is what defines engineers, is it not?

Helping others

Developing engineering skills in others has always been part of my activities. I have tutored students, especially female students, in electrical and electronic engineering for short-term internships and graduation final projects. I let them see that anything is possible, even if it seems difficult – just like it seemed to me. But keep going, nourish your eagerness to learn, stop being shy, ask questions! Embrace failure, as it teaches you success,

as long as you are doing what you love.

I have been assigned tasks where I had no clue what they were about. I learnt about the electronic management of conferences and editing and publishing the proceedings. I used what I am good at, I reviewed scientific papers and coached startups. Using my inherent skills (the eagerness to learn, explore and do experiments) I developed other skills by “learning by doing” – work hard, don’t be shy to seek guidance. When I had to review a paper for a scientific journal for the first time, I was not shy to ask the chief editor for guidance.

To produce a booklet for the IDT’2014 conference, I asked a colleague to provide me with a template. And for my hard work and determination I gained respect, trust and appreciation. Instead of two recommendation letters needed for my TechWomen application, I got three great ones from my superiors!

Rising to the top

Instead of being just the publication chair of IDT’2014, I could manage the conference electronically, coordinate the programme committee and assist the conference chairs. They valued my efforts and decided that my name should be added to theirs on the conference chairs’ foreword. I also received a certificate of appreciation from the Test Technology Technical Council for providing outstanding student volunteer services for IEEE IDT’2014.

I want to keep contributing to my society, to advancing technology, to building and designing circuitry, to mentoring students.

Have I faced failure? Yes, many times.

Have I forgotten the reason for which I moved to Algiers and joined the CDTA? No, I have not.

Am I done with learning? Not yet! When I face a challenge, I always tell myself, "Go for it. Do it!"

And so far, so good.

JOURNEY 2

CHANGING THE NARRATIVE ON A WOMAN'S POTENTIAL

Miriam Modong Dangasuk
Chemical and Process Engineer
SOUTH SUDAN

Born into conflict

I was born in Juba, the capital of one of the world's youngest countries, South Sudan. I was born before its secession from Sudan, and into a civil war, with the Sudanese government on the one side and the Sudan People's Liberation Army (SPLA) on the other.

My family moved to the former capital, Khartoum, to avoid the effects of the war and to provide me and my siblings with a better life. At the time I could not comprehend what was happening. But then again, I was only one.

Language, religion and resources had a defining impact on my initial education and my parents' ultimate decision to move the family to Kenya. I was not able to attend an English primary school and went to an Arabic-

medium school. We could not freely practise our religion as Christians because Islam was the official state religion and Sharia law defined the system of governance. The adaptations we had to make were heart-wrenchingly difficult for both myself and my parents.

Foreigners in Kenya

Language barriers did not stop at the border, however. When I started nursery school, I realised that all the children spoke Swahili. It was a foreign language and the fact that I couldn't speak it led to strong feelings

ABOUT THE AUTHOR



Miriam Dangasuk is a professional chemical and process engineer, and an energy and environment engineer and policy expert, with over six years of related work experience in both private and non-profit sectors. She is also a member of the Young African Leaders Initiative (YALI).

She is currently working for the Africa Center for Strategic Progress in Washington DC in the USA, where she explores ways of promoting the responsible use of energy, natural resources and the environment. She conducts extensive research into water and food insecurities, power and clean energy, and the implications of climate change in Africa. Previously, Miriam worked for SABMiller as a technical brewer, the International Committee of Red Cross as a water and habitat engineer in South Sudan, and for Schlumberger as a field engineer in Stavanger, Norway.

In addition to her vast experience, Miriam holds an MA in global environmental policy from the American University in the USA, an MSc in environmental and energy engineering from the University of Sheffield in the UK and a BEng in chemical and process engineering from Moi University in Kenya. She is also an alumnus of the Mandela Washington Fellowship with a focus on energy management from the University of California Davis in the USA.

of isolation and loneliness. I felt that I could not participate in school activities, as I spoke neither English nor Kiswahili. Nevertheless, and with the support and encouragement of my parents and teachers, I was able to overcome these challenges. I excelled academically and became one of the top performers at the school, adjusting quickly and learning the local lingua franca.

Role models: my parents were fair

It was also at this time that I understood divisions and injustices. My parents, however, set a good example by dividing household chores equally between myself and my brother and sisters. It inspired me to think about equality, the importance of inclusivity and gender roles. In my family no one was treated differently and we cultivated a strong ethos of equality and humanity.

By the time I was in high school, I settled into fulfilling positions of leadership. I served as a student leader and learned to juggle the pressures of academic work with my important new role. As challenging as this was, I had enough free time to read motivational books. My favorite ones were *Gifted hands* and *Think big* by Dr Ben Carson. His story made me admire his career path and influenced my love for science.

My parents also instilled the value of hard work and discipline in me. I therefore knew that if I put in the work and studied diligently, I would excel.

It was my family who advised me to think about engineering, since I

loved science. At that time there was little career guidance in schools. I remember going independently to a cybercafé and scouring the internet for any information about different engineering disciplines.

Accordingly, while at the university, I decided to pursue a career in engineering, specifically chemical and process engineering because I enjoyed being in the lab and experimenting with chemicals. The idea of creating and designing processes to solve societal problems using technologies while minding the environment fascinated me.

Disenchantment with the system

Once I began attending one of the top universities in Kenya, I realised, for instance, that the number of women in my engineering class was significantly smaller than that of men.

In addition, I realised that sexism on campus existed and that some of the women were victims of prejudice and sexual harassment by men. I myself became a victim of an unsolicited sexual advance from a male professor. He only stopped his advances when I threatened to report him to the university administration.

Regardless of these challenges, I enjoyed my time at the university and participated in sports and exhibitions. For networking and skill building purposes, I joined the school's editorial board as an extracurricular activity and helped to publish the annual engineering magazine.

During long school holidays, I attended internships at different

companies where I enhanced my leadership, problem solving and critical thinking skills. My supervisors commended me for my hard work and commitment to learning.

My most memorable internship experience was at a brewing company. My manager was duly impressed with my curiosity and troubleshooting skills. He encouraged me to look for ways in which to improve processes in companies so that my prospects as an engineer would be enriched. Later, when I started working, he contacted me to congratulate me, and since then he has been one of my most important mentors.

A divided workforce

After completing my undergraduate degree, I found a managerial job at a multinational brewing and beverage company in Sudan. As a manager, I oversaw 24 people – 22 men and two women. It was a challenging experience, given that Sudan is a patriarchal society. Some of the men palpably disrespected me because I was a young woman and also felt that I was not competent. I had to work hard to build that trust.

They felt that as grown men, some married and others fathers, there was no place for a young woman asking them questions, guiding them or correcting them. This was incredibly frustrating, but my communication and problem solving skills played a key role in building their trust. My direct supervisor was also very supportive in ensuring that they were respectful, which reduced the overall sexism.

Away to Norway, then back home

I eventually left the company and accepted a position at an international oil and gas company in Norway. Although the women who worked there were also in the minority, everyone respected each other, which was a huge contrast. I appreciated how women were treated and wished it could be universally applied.

When the oil crisis of 2014 hit, I was to be reassigned to another country in the Middle East due to the large loss of contracts. However, my manager informed me that the only available country I could go to at that time did not want a woman in the field. I was dismayed that being a woman limited my career progress due to the unavailability of a “female-friendly” location.

This did not stop me from working in the engineering field, as many opportunities remained wide open. I started working at an international humanitarian organisation, where I chiefly carried out projects in the rural areas. Once again, this did not come without being faced with inappropriate behaviour at some of the field sites. Some men from the area, for instance, would come to me and ask for my hand in marriage whenever I worked on the site. I felt undervalued and sometimes I would have to lie that I was married already just to be left alone. My experience with working with male colleagues has been mixed. I have met some who encouraged me and I count many of them as friends.

On the other hand, the female colleagues were always together,

supportive and understanding because they experienced similar challenges. We are proud of each other's successes because we relate well to each other's experiences. In the end, however, and probably due to circumstance, I have more male friends than female ones because of my field.

Giving back and making a difference

The issue of gender is something I keep close to my heart and I soon began making a point of empowering girls in rural areas. At one stage during my field assignments, I drove a doorless gator utility vehicle and young girls would stop to stare and be amused. It was probably the first time they had witnessed a woman driving. They clearly could not believe it. I am glad that they were able to take advantage of my presence as an inspiration by showing that girls can do anything that they set their minds to.

One of the highlights of my professional career has been my time in the field when our team was drilling boreholes to create a water supply for rural villages in South Sudan, which is now my home country. We also rehabilitated old boreholes using solar pumps and technology. Seeing tangible results from one's work that really makes such a fundamental difference to people's lives is an incredible feeling.

In 2016, the second civil armed conflict broke out in Sudan. I was in the field and had to be evacuated to the capital. It was a stressful time and I did not know if I would survive. It was during these times that I learned to appreciate the life I was given and think more seriously about ways to

contribute to my community.

Today, I have moved more towards being a policymaker and have more of a leadership and management role, but that time in the field is what has inspired me to keep going and make a real difference to African society through the work I do. Working as a resource, energy and environmental policy analyst puts me at the frontlines of facilitating societal change, and that feels really good.

We need diversification – and badly!

As innovation continues to grow in the engineering sector, I believe it is important to diversify to bring in and challenge different perspectives through different voices. This can be done by encouraging more women of all races into STEM careers to assist in driving innovation. I partnered with some of my friends and began conducting STEM training at high schools in Juba, using grants that we applied for. We also paired these high school students with university students studying sciences and engineering to act as their mentors. I wanted to be a role model and motivate girls.

An engineer's life and a love of literature

One of the hard realities of being an engineer, especially if in a field position, is spending many days and sometimes months away from home and family. This is a big sacrifice and can be lonely. Nowadays, however, many companies are ensuring a sensible work/life balance. In a previous job, for instance, I would be given frequent breaks to rest and relax with

loved ones.

Additionally, I like exercising and reading novels during breaks when I am at work and travelling during vacations. I mostly read novels in Kiswahili or English due to my education in Kenya.

I love the novels of Nigerian author and feminist Chimamanda Ngozi Adichie. She is a huge inspiration for me as a writer, leader and activist for gender rights. She was the keynote speaker at my friend's master's graduation in 2019, where I was able to get her to sign a copy of her novel *Half a yellow sun* for me. It was an amazing moment!

I have been able to travel extensively across Europe, as well as some countries in Africa, Asia and the Americas. I regard sharing these experiences with women thinking of working in the field beneficial, as I believe it will help them find the profession more appealing.

Post-war: studies continue and so does life

After the war, I decided to go back to school to pursue further education, as I have always wanted to blend engineering with policy. My family and friends were already proud of my accomplishments but encouraged me to further my education.

I knew that I wanted to study abroad. It was certainly expensive, but I applied for scholarships and grants. I was awarded the Chevening Scholarship, which is part of the UK government's global scholarship programme and funded by the Foreign and Commonwealth Office (FCO)

and partner organisations.

This enabled me to pursue an MSc in environmental and energy engineering in the UK. After completing this, I was awarded a Civil Society Leadership award by the Open Society Foundation that took me to the USA to study for an MA in global environmental policy.

While studying in the USA, I also worked as a graduate teaching assistant. This exposure to teaching made me fall in love with educating the world's future engineers.

To me, an engineer's main role is to solve societal problems. This powerful notion gives me job satisfaction and I aspire to continue mentoring girls into this field through STEM training. It is difficult in South Sudan because many girls, especially those in rural areas, do not have access to education.

Either their parents do not see the value in sending the girls to school or the girls themselves choose to get married and/or have babies instead of finishing school. There is a need to show them that not only education can bring value into their lives in terms of opportunities but how STEM courses are important in tackling big issues such as climate change.

This, I believe, will improve their lives as well as give them financial independence. This is why mentorship and being an active role model is so crucial to me. I am, after all, a beneficiary of mentoring, and it has never made me second-guess my capability as a woman or as an engineer. Instead, my mentors have nurtured my self-confidence and encouraged me to be

ambitious and pursue my dreams.

Hope for the future

Despite engineering being such a classically male-dominated field, I think being an engineer has empowered me. It has proven to me that I can excel, break barriers and reach greater heights. It has taken me to different countries and continents, made me appreciative of different cultures and systems and taught me to adapt to new conditions.

The Covid-19 pandemic has proven to many organisations that much work can be done remotely, and this is good for nursing women or people who want to work from home. Women should not feel that they have to put their careers on hold in order to raise a family. Instead, they should be encouraged and supported to enable them to flourish career-wise.

My dream is to see more women represented in the engineering field, offering solutions for their communities and reaching great heights. Countries and societies must make a conscious effort to showcase female contributions in order to change the narrative and move our hearts and minds forwards and upwards.

JOURNEY 3

EDUCATE A WOMAN, EDUCATE A NATION

Loice Gudukeya

*Chairperson and senior lecturer, University of
Zimbabwe's Industrial and
Mechatronics Engineering Department*
ZIMBABWE

Boys fix bicycles, girls sew buttons

I was born and raised in Harare, Zimbabwe. We were a family of two girls raised by a single mother. I am the youngest. My mother was a primary school teacher and most of my close relatives were either high school or primary school teachers. Even my older sister grew up to be a high school teacher. I was therefore left with a narrow view of possible professions for myself in those early years.

My mother pushed for excellence in school and was determined to raise two independent women capable of living well-balanced lives and pursuing fruitful scholarly activities. Looking back, I think it's fair to say that I rose to both challenges when I chose engineering despite its pressures. This is

largely thanks to my amazing mother, who remains my biggest champion, along with my supportive husband.

Growing up, I was part of a vibrant community in a densely populated suburb. To a large extent, children were raised by the entire community. We spent a lot of time outside, playing energetic games in the streets. I noticed from a young age that in families that had both parents around girls were raised differently to boys. Duties tended to be gender-specific, with outdoor duties reserved for boys and indoor duties, such as cooking, cleaning and sewing, for girls.

ABOUT THE AUTHOR



Dr Eng Loice Gudukeya holds a PhD in engineering management from the University of Johannesburg, an MSc in renewable energy from the University of Zimbabwe and a B(Hons) in industrial and manufacturing engineering from NUST (Zimbabwe). She is chairperson and senior lecturer in the Industrial and Mechatronics Engineering Department at the University of Zimbabwe. Her research areas are environmental sustainability and cleaner production (methodology) and she has published various papers related to this field.

One of Loice's main passions is promoting engineering to primary and high school girls. She currently chairs UZ Women in Engineering, which falls under the Zimbabwe Institution of Engineers' Women in Engineering division. Its mandate is having a community of women in STEM at the university to promote higher numbers of females in the field. Known as the Pink Helmet Brigade, they host different educational and STEM awareness events that bring together the female engineering students on campus.

The general pattern was intended to direct girls towards becoming good wives. This was based on the idea that women had to adopt a caring role for their husbands. Should a button fall off a husband's shirt, the wife had to know how to replace it. In anticipation of this traditional wifely role, girls had to cook and play with dolls. Heavy-duty jobs in and around the house, such as trimming trees, fixing cars, bicycles or toy cars, were out of bounds for girls.

I believe that while these assigned jobs did instill discipline in kids, they were too gender-specific. As much as traditional roles helped cultivate good values in the children, they did not have to be restricted to girls or boys. Fortunately, my open-minded single mom shared this more liberal view.. She raised us to be able to tackle everything hands-on, even the outdoor jobs. And our neighbours eventually cheered us on too. It just goes to show what leading by example can do to change society.

Courageous choices and breaking the mould

I started resenting the assumption that I was destined to become a teacher. I began to wonder about my options and to explore alternatives. The subjects I loved most and excelled at in middle school were undoubtedly mathematics, physics and chemistry – certainly not the traditional or popular choice for girls. I also had a natural flair for fixing anything technical or electrical in our home. I therefore started exploring possible apprenticeships and considered taking my top subjects to the advanced level.

By the time I reached A-levels, something wonderful happened. I

attended a vocational guidance event that opened all sorts of job and career possibilities for me. It was the first time I heard about different options in the field of engineering.

Of all the available avenues, I fell in love with chemical engineering. By the time I reached university (NUST in Bulawayo), my friends had however encouraged me to do industrial and manufacturing engineering (because of better career options) instead. I went with this choice as it made practical sense and I am happy to say I have no regrets. My mother was very excited for me when I left home for the first time to start a five-year degree. In typical fashion, she sacrificed everything to make my stay 460km away from home as comfortable as possible.

Leaving home for five years sounded like a lifetime in my neighbourhood! My community asked questions like “If you are going to university that long, when will you get married?” or “Isn’t engineering a man’s job?” To most people in our hood, an engineer was a glorified mechanic, so the concern about my choice made sense in the context.

But I was excited and luckily my mother thought more broadly and remained open-minded and supportive. She was happy to give me away in marriage only after I qualified. The need to please my mom and make her proud became my biggest drive.

I prioritised my studies over my social life, knuckled down and worked very hard right up to my first graduation. In the end, the entire neighbourhood celebrated my achievement and regarded my mother with

appropriate admiration. I am so grateful that I lived up to her expectations and also found a suitor who was as supportive of almost everything I did as she was.

The luck of enlightened company

In my class at university, the ratio of men to women was 9:1. However, our direct male colleagues treated us as equals and with respect. In fact, I was elected as class representative for all five years of my university career. The whole class loved how organised I was and therefore worked hand in hand with me. I remain very organised to this day, which helps me manage my diverse roles effectively, including that of a new mother.

One incident that proved particularly difficult also demonstrated how well my class worked together. Our group was verbally attacked and slurred by a group of three male students two years our senior who were part of the same degree programme. Their class did not have any female students, and upon learning that a female was our class representative, they began to verbally scorn us. They started with me, but I chose not to react. And I didn't have to, as all the gentlemen in our class immediately jumped to my defense.

This was a significant day for me as I felt genuinely supported. I only hope women in engineering are as supported by their male counterparts in this manner today. During all my time at university I never felt that I needed to prove my worth, nor that I was in the wrong lane. I was lucky enough to be in enlightened company.

The sting of disappointment

Upon receiving my undergraduate qualification, I was very enthusiastic about joining the industry. There were several graduate training programmes that I really wanted to become a part of. However, the country's economy was becoming more and more tenuous. Companies were no longer taking on the same number of trainees and I felt the sting of gender discrimination once again. Most of it came from established engineers in the field who had most likely trained with far fewer, if any, women in their classes.

I remember one interview where I felt I had performed very well. Two candidates were needed. I was one of the final three to be shortlisted. The other candidates were classmates, so we shared all the details of the interviews. I appeared to be the only one who had been given a tour of the factory, details of the shifts and advice on how their transportation worked. I felt optimistic.

Then something totally unexpected happened. Upon learning that I was 25, the inhouse HR representative told me in no uncertain terms that during the graduate training year no provision would be made for maternity leave. Unfazed, I chuckled and told him I was not even married, to which he replied with a stern face, "becoming pregnant has nothing to do with being married". To make matters worse, I received phone calls from my two classmates a day later. They informed me jubilantly that both of them had been called in to sign contracts. I, on the other hand, waited for a phone call that never came.

I was not even given notice that I did not make it. This was one of the biggest disappointments in my career.

Teaching days

As the commercial sector was fortunately not my only option, I decided to join the world of academia. My first job was as a teaching assistant at the then Harare Institute of Technology. It was both refreshing and heartening to discover that in academia you hardly have to prove yourself against your male counterparts – your work simply speaks for itself. After obtaining my master's degree, my confidence in my own teaching abilities improved and I saw that students had more confidence in me too.

Attaining my PhD soon after honed my research skills, which also improved the quality of the projects I supervised at both undergraduate and postgraduate level. Academia has provided me with a gratifying career and some measure of flexibility, which I appreciate. It's been a real blessing.

A leader of men and women

Today I am senior lecturer and chair in the Department of Industrial and Mechatronics Engineering at the University of Zimbabwe. But let me tell you, being the only female academic in the department and working with male colleagues, many of whom are much older than me, initially made my promotion to the position of chair truly terrifying. However, the experiences gained during my PhD training prepared me to exhibit professional conduct at all times.

I used to believe that to make my point in a male-dominated environment

I had to be the loudest. Age and experience have however taught me that the opposite works even better. Sometimes just calmly explaining your point once drives the point home. I am feisty by nature, so this required that I alter my personality to some extent. Maintaining professionalism, however, is the true name of the game.

There is a saying that if you educate a man, you educate an individual, but if you educate a woman, you educate a nation. This is true in my experience in academia. The other women in my faculty and I stand out for two reasons: we are passionate about how we deliver our teaching material and supervise projects, and we want to see our students succeed, not only in their current studies, but in life as well.

My female colleagues are for the most part wholly supportive. We obviously have our differences, but we celebrate our successes as a team – we root for each other's success and keep each other motivated and inspired. We all want more women to populate our profession. If I can inspire just one more woman to become an engineer, my life will be complete.

Self-confidence in the face of adversity

The nature of my job allows me to maintain a good balance between work and family. It also requires discipline and detailed planning. My policy is to diarise and prioritise and then have the discipline to stick to the plan.

I place great value on my family, so I resist, trips that will take me away from them for an extended period. This is a decision I made so that I can keep the good balance I have maintained between my work and family.

My husband and I recently adopted a baby girl and so now I have a new role – that of mother. Together with my husband, we are looking forward to raising an independent woman who will grow up secure enough to make her own decisions. At the same time, I might be tempted to encourage her to follow the engineering path.

Planting the STEM seed far and wide

Before the onset of the Covid-19 pandemic, I spearheaded our university's Women in Engineering Committee and had outlined a number of activities that we had already begun to roll out. These included visiting high schools and showing the girls that engineering is a viable career choice. Crucial roles in large organisations are increasingly being assumed by remarkable women, whose hard work and dedication will not only empower them but set the example for future generations on our beautiful African continent.

Make your stay enjoyable

My biggest dream is to tip the ratio of men to women in engineering from 4:1 to 1:1. This will only happen if we sustain interest and study in the field by women and for women. Respect for women must remain a top priority on their way to and in their careers too. Either way, to all the girls and women still deciding, I would like to say that engineering is a fantastic career choice. It allows you to be creative. It allows you to be passionate. It allows you to design our future. And to the women already in the field, I leave you with this: make your stay here enjoyable!

JOURNEY 4

COOL OPERATOR

Tognon Clotilde Guidi

Professor in energetics and mechanics

BENIN

Laying the foundation

My name is Tognon Guidi and I'm from Abomey, a city in Benin. I was born into a family of traders on 25 June 1965. My parents are Rene and Assiba Jeanne Feliho Hona. My family is polygamous, which means my father had more than one wife. I'm the fourth and youngest of my mother's children and the 14th of my father's 18 children.

I lived in Abomey until I received my high school diploma, majoring in mathematics. My elder brothers and sisters were very industrious, but their workplaces were far from home so we did not always see them. To keep myself busy, I loved playing ludo and bouhountou, a game in which partners snap their hands and then their feet.

A lesson learnt: schooling is important!

School was a big deal for me and the rest of my family. My parents, brothers and cousins taught me a few things about it. They were quick to tell me to work hard, listen in class and persevere. They also taught me to

ABOUT THE AUTHOR



Tognon Guidi is a professor in energetics and mechanics. She is the first female higher-ranking teacher/researcher in engineering sciences and techniques in Benin and in the African and Malagasy Council for Higher Education (CAMES), and Benin's first female cooling and air-conditioning engineering specialist.

Since 2016, she has served as the deputy director of Lokossa's National Higher Institute of Industrial Technologies (INSTI) at the National University of Sciences, Technologies, Engineering and Mathematics of Benin (UNSTIM). She is also the director of the Laboratory of Processes and Technological Innovation (LaPIT) for INSTI.

Tognon is also a research fellow at the National Technical University of Astrakhan in Russia and a lecturer and researcher at the Laboratory of Applied Energetics and Mechanics (LEMA) at the Polytechnic School of Abomey Calavi/UAC.

She is the general treasurer of the National Association of Benin Refrigeration and Air-Conditioning (ANFCB). Tognon is also an active member of several associations: The Association of Women Scientists of Benin Universities, the International Academy of Refrigeration, the African Associations Union of Refrigeration and Air-Conditioning Actors (U-3ARC) and the African Engineering Deans Training Schools (AEDC).

Tognon has co-authored a book on the exergy analysis of systems. She is the author of about 40 articles and a dozen technical specifications and posters. She has also participated in drafting projects, several of which relate to training in technical education.

cultivate integrity and honesty and stay out of trouble (like walking around with boys). My parents also said that as a girl I should cook and clean (and not play football with boys).

Unfortunately, my father passed away when I was a student. After he died, my mother supported me until I graduated from university. Sadly, I also lost my mother the year I became a civil servant in Benin. May their souls rest in peace.

I went to primary school in Abomey and did my high school studies at the Collège d'Enseignement Général I, also in Abomey. During my schooling, I got three awards for excellence. I received a special award from one of my mathematics teachers, Ignatius N'vekounou, who said, "I have a student named Clotilde Guidi who works very hard and deserves to be recognised."

Some pupils wondered how a girl could do so well in mathematics. The answer is simple: I always strove to surpass my own standards and give the best of myself. It should be noted that I was the only girl who majored in mathematics in my senior year of high school. The boys in my class appreciated my courage and determination for pursuing it. It was during the discussions on career choices in the first and final classes between teachers and learners that I heard the word 'engineer', but I didn't yet understand what it meant.

The siren song of STEM and a cold chain reaction

As I was finishing high school, I looked for a field of specialisation in which I could apply the laws, principles and theorems I'd studied in physics

and mathematics. I soon learnt about STEM training and completed several admission tests to study at engineering schools in Benin.

One of my brothers initially supported me financially but I also applied for foreign scholarships. I enrolled in mathematics and physics at the Faculté des Sciences Techniques of Université Nationale du Bénin, and after my test results came out I was admitted to Benin's principal public university, the Université d'Abomey-Calavi, to become an agronomic engineer.

After successfully completing my first year in agronomy, I received a Russian scholarship to study physics and low-temperature techniques from 1988 to 1994. I seized the opportunity with gusto. I was excited to learn all about cold process production and how to extract heat from a cold environment and reject it in a warm environment. Cold chain, as it is known, is essential in helping to meet a nation's goal of sustainable development.

My family was happy that I got the scholarship to study abroad, even though the separation for six academic years was not easy. On the day they dropped me off at the airport, the whole family cried.

I was, of course, aware of the value of marriage and family versus my career. Both were life goals for me but I planned to finish my studies before getting married. Luckily, fate brought my husband and the father of my children to me during my STEM training. We worked in the same field of specialisation.

Widening the circle and learning to mingle

The male and female students got on well during my first year at

university in Benin, even though there were only three women in our class of 35. There was no difference between us and the lecturers treated us equally. The gender situation was much the same at university in Russia. In our class of 30 students, I was one of three women and the other two were Russian.

At the beginning of my training, and not knowing the Russians yet, I mingled with other African students, especially the Beninese ones. But after a few months, we all started mingling. There was a good atmosphere between the men and women. I sensed no discrimination between us and the lecturers treated us equally. My student group was truly cosmopolitan. In Benin as well as in Russia, I was on good terms with all the other female students.

Learning to teach

After graduating as a refrigeration and air-conditioning engineer in 1994, I did a year and a half of volunteer pre-integration internships. Given the limited number of refrigeration and air-conditioning companies in Benin at the time, I couldn't easily find a position, so I established my own refrigeration and air-conditioning maintenance company. In fact, most of my female compatriots in the field had to start their own businesses.

As a refrigeration and air-conditioning technician, I fought the stereotype of the profession being for men only. I was able to build a reputation in several departments, including maintenance, servicing and installation work on refrigeration equipment. It wasn't long before a local technical high school appointed me to teach refrigeration and air-conditioning

classes. That was where I discovered a passion for teaching, which paved the way for me to become a teacher.

I was the only teacher with the opening of the Refrigeration and Air-conditioning Department of the Technical College of Bohicon (LYTEB), where I led the first batch of students to complete an industrial technician diploma.

My motivation was to work well. The encouragement that both men and women gave me when they saw me climbing the slabs to repair the air-conditioners was great. I shared the Beninese sector for repair, maintenance and installation of refrigeration systems with colleagues and refrigeration specialists.

Entering academia

In September 2000, I was recruited into public service as a certified physics, refrigeration and air-conditioning teacher, and was accepted as a university lecturer in 2004. I was the first female lecturer, and the only lecturer in my department until 2007.

My male colleagues appointed me as the general secretary of the teachers' union, where I stood up for causes close to my heart. As is often the case with union representatives, my superiors sometimes didn't appreciate my actions and often showed contempt for my interests.

I'm convinced that fast, well-executed work is the key that allowed me to obtain distinctions at work. My fellow academics have often asked me about the secret for success. My answer is simple: Do the work well, and do it fast.

Oui, madame, I am no sir!

My commitment to service is reflected in my sense of belonging to a team, sharing common values, active participation and my ability to go beyond the limits and to put effort into everything I do. Since I started working at university, there's always been a sense of shared purpose between me and my colleagues and collaborators. I've had a lot of positive feedback from students about my teaching, especially the practical work.

They sometimes accidentally call me sir instead of ma'am because most of their teachers are men. I've heard some of my male students say, "If a woman has reached this level, we men must do everything to go beyond the level of our teacher." But at my work, women and men are treated equally. The job grade is the same, as is the remuneration.

Family ties

I'm the mother of two daughters and the grandmother of a little girl who keeps me busy when I'm at home. My daughters are grown women, and both are both engineers. The eldest is a computer and telecommunications engineer, while the youngest is an electrical energy engineer who specialises in electronics and embedded systems. I assist them whenever they need my help.

I'm no longer with the father of my children and dedicate my life to my professional career and my children's education. I've instilled the same values I was taught in them: respect, sincerity, courage, acceptance, consideration, appreciation, mutual aid, reciprocity, solidarity, listening, benevolence, brother- and sisterhood, affection and love for others, hard work at school, cooking abilities, budget management and a strong work

ethic.

My family is important to me and I learn and receive so much from them. When my children were young, my siblings helped me take care of them as I studied and pursued a career. Still, I was always available to them, throughout primary, middle and secondary school.

I've always benefitted from my family's help during my career-related absences. Even having to be away from them at times, I managed to be present in my children's lives and to educate them. Many members of my family have given me invaluable advice on my role as a wife and mother. But as I'm in a position of responsibility at work, there have been times when it's been hard to balance my work and personal life.

Cultivating future female engineers

I really appreciate the positive, cooperative atmosphere among colleagues and supervisors in my department. Because I respect the value of public service, I manage to work well with people from different cultures. I rarely witness discrimination. I collaborate with colleagues in scientific research and in publishing our results.

Several colleagues have helped me to accomplish my mission, and for this I am grateful. As a woman of action, I believe in sustainable proposals. All vocational training centres and institutions in the STEM sector should offer a week of welcome and orientation in a professional environment to ease the introduction of young women to the vocational training circuit.

I also think we should develop the practical dimension of STEM training in higher and secondary education, with a view to bringing it closer to the

realities of the sector. We should schedule specific and targeted training modules for the profession in order to strengthen the capacities of young women graduates in project management and to promote vocational training.

Companies should be encouraged to mentor female trainees and we should help young women participate in these internships. We should encourage the recruitment of women, facilitate their access to the sector and give them the opportunity to prove themselves in traditionally male professions. There should be financial and practical incentives for private companies to appoint more women.

The STEM sector should have projects to promote entrepreneurship, as well as business assistance programmes and expertise partnerships to help women entrepreneurs. International donors should be implored to target the STEM sector with employment programmes, and we should promote social partnership in all programmes to facilitate the transition from education and training to employment.

Having said all that, the role of women in the workplace has definitely started to change. The organisations I work with are now more comfortable assigning important roles to women.

JOURNEY 5

THE GIFT OF KNOWLEDGE

Ilham Kissani

Professor of engineering management,

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MOROCCO

The fascinating city that formed me

The first thing you need to know about me is where I come from and the huge impact this has had on my life, both as an engineer and as a woman. I would like to elaborate on my geographical home – the incredible, vibrant and inspiring Moroccan city of Fes.

Founded between the years 789 and 808 by Idris I of the Idrisid dynasty, Fes is Morocco's third-largest city and home to more than a million people. It is also a Unesco World Heritage Site, brimming with spectacular monuments and buildings erected by various dynasties over the past 12 centuries. This magnificent city is also regarded as the home of all things spiritual, cultural and scientific. It is unique in that it is host to the oldest university in the world founded by a woman – Fatima Alfihrya.

I am convinced that the magic of Fes rubs off on its inhabitants. It turns many of us into artists, artisans, seekers, learners, teachers and scientists. It was in this inspiring setting that I was born in 1978 into a big, industrious family that collectively strove for excellence. This group was made up of my father, mother, four siblings and our two grandmothers, who instilled in me the wisdom to be tolerant and to try not to take things personally.

A well-managed family dynamic

Growing up, I remember my father as a true character – enthusiastic, animated and high-spirited. He was driven by a passion for quality in all things. He was also very family-orientated and dedicated to his children's

ABOUT THE AUTHOR



Dr Ilham Kissani is professor of engineering management at the School of Science and Engineering at Al Akhawayn University in Ifrane (Morocco). She has served as the main advisor and lead instructor of undergraduate and MS programmes in engineering and management systems since 2010. She has helped create close ties with the AUI School of Business Administration, which allows both schools to leverage resources and deliver a greater diversity

of courses to students, such as supply chain management and operations management.

Her background is diverse and includes industrial as well as academic ventures. Her degrees are from INSEA in Morocco (engineering) and Université Laval in Canada (master's and PhD). She has worked with Royal Dutch Shell as a project manager and with Modellium Québec, where she consulted in logistics and supply chains. Additionally, Ilham contributes to research in supply chain management, planning, and operations research. She is a member of ASEM, IEEE, IEOM, IIE and INFORMS.

education. Between the ages of five and seven, I would walk with my father to school and he would go to his office nearby. This formed a close bond between us that shaped my life. This special opportunity was exceptional, and emotionally and intellectually productive in my eyes. It was something I only fully appreciated the impact of at a later age in my adulthood, and unfortunately my other siblings did not all have the same opportunity.

The open, two-way communication shared with a loving, patient and understanding parent benefitted me greatly. The time we spent on each day's walk enabled me to share thoughts and feelings while having his full attention and without experiencing any form of censure or criticism.

When teachers praised me, I was always in a hurry and proud to share my successes with him. When disappointed by something or someone, I also needed to talk about it and share my feelings. I was able to freely express both these negative feelings and more positive emotions with my father as confidant and mentor. This rare opportunity for deep communication built my sense of confidence and trust, and developed a robust relationship between us. I will never forget the time we spent strolling and talking companionably.

My mother supported my father in this pursuit. She was also the household manager and excelled in her efforts. It was a happy, highly functional home. In terms of our family dynamic, each member of the family had a clear set of tasks and chores. We were treated equally and

despite the opposing personality types of some of my siblings, my father maintained an equal distribution of discipline.

Be the change you want to see in the world

My father always maintained that there were two types of individuals who will neither acquire knowledge nor learn any valuable life lessons: overly arrogant people and people with low self-esteem. Those who want to go far need to prepare a long time ahead and nurture self-belief and confidence, he said, and he was right. Today, my personal motto is: “Be the change you wish to see in the world. Make an impact wherever you go.” And this is what I always try to do, as a parent, mentor and teacher.

Choosing engineering

I was enrolled in a good junior school but unfortunately it was far from our house, so my father decided to take me to another school that was a bit closer. Here I did very well. I was almost always ranked first or second in my classes and won several academic awards.

In my first year of high school, when we had to decide on a major, I chose mathematical science, the only one leading to engineering disciplines. Already as a youngster, my path was directed towards STEM.

My eldest sister had studied pharmacology, my brother medicine and my middle sister linguistics. All three were part of what I like to call “group 1” of my siblings, as my parents waited ten years before having me and my brother, or “group 2”. We all had our passions and mine was definitely

science and technology.

I was in high school when I first thought about pursuing engineering as a career. In life orientation classes, we learnt about the connection between subject choice prior to graduation and which university discipline it would allow us access to. I was already keen on going into something like engineering and my family fully supported this choice.

I was single-minded and I've known since middle school that I would study engineering. All the universities I had applied to were engineering ones. Some female classmates ended up changing their major to education or medicine, but I was determined to stick it out.

Fighting skewed perceptions and gender stereotyping

When I initially announced that I was going to study engineering, all my friends told me that it's a hard discipline and that I might give up during my studies. But that's exactly what motivated me to rise to the challenge.

Gender roles were still very much prescribed in those days and a woman studying in this field was by no means common. For instance, the idea that women were followers and men leaders was taken as a given; ditto for men being the primary decision-makers. Despite this I decided to enter a career in an influential sector that traditionally dominated by men.

In terms of the virtue of marriage and family over career, my parents insisted that I finish my studies before marriage. I got married when I was in the middle of my master's degree course. My family remained supportive, while reminding me of my objective to ultimately obtain a PhD. Their support and the unfailing backing of my loving husband helped me achieve

this goal.

At work, it has however been disappointing to see how women are sometimes treated. I am particularly referring to the environments in which I have worked as an employee or intern – the commercial industry and academia. The division of decision-making in the professional world is closely assimilated to dogsled racing (a great analogy I once read in a book).

I found that as a woman I am always welcome to make behind-the-scenes decisions to ensure that a team makes it to the starting line. Every project activity is monitored, controlled and coordinated to achieve project objectives. Important activities include setting a plan and milestones, communicating with stakeholders, monitoring costs and making timing estimations, controlling quality and managing changes, and all this work is welcomed. As women, we are also praised and recognised for identifying activities and detailing their sequencing and execution, including cost estimations and budgeting. Women can assemble the team, decide who is doing what which amount of effort is needed for each task and who has to pull more weight.

But on race day, when the cameras and spectators show up, it's men who take the reins and the glory, not the women who actually worked to orchestrate everything with systematic planning and careful implementation. Women often put in the effort without getting the credit or recognition they deserve for helping their team over the finish line. This isn't right or fair, and can be very frustrating.

I try to implement the change I want to see through the projects I lead.

I always aim to set things up so that should I have to leave the project, the rest of the team can take up the reins. I want to empower them and give them the recognition they deserve. I want to educate and create greater awareness of process operations in case a scenario happened that obliged me to switch to another project. I also do this to bring balance to the workload, so that everyone has a significant part to play.

Sometimes, I believe that the strength of women's decisions lies in women's intuition. But most of the time I find that women are just as data-driven and analytical as men.

University days and the gender wage gap

The first thing most people ask of any engineering student is usually about the gender ratio at university. In my case, for every three women there were 20 men in the preparatory year preceding the university. In studying engineering, I took this to heart as being symptomatic of what was expected of women in modern society. But I pushed through. Now I can say that we have more women in engineering studies, at least from what I've seen in the courses I teach. It is still not equal, though.

I see that women are still struggling to strike a balance between the often-conflicting demands of work, family life and personal well-being, often sacrificing the latter for success and gaining status in the workplace and community. Not only are women still confronted with these issues, but they are also often paid much less than their male colleagues in exactly the same position. Unfortunately, the most prevalent issues still lurking in the workplace for females pertain to gender discrimination.

Cultural and racial barriers

Much can also be said about racial discrimination, which I experienced while studying and working. I also know that immigrants and women of colour make far less money than locals. It's heart-breaking to realise how many still have a difficult time succeeding due to systemic racial and cultural barriers.

When I started my PhD in business administration, the French department head was infamous for putting up barriers for foreigners. He actively sought to fail North African students or slow their progress. Students complained to each other constantly, but no official complaint ever reached top management, because the students were too worried about failing.

By working extra hard, I was able to finish my degree in the Engineering Department. After this I broadened my horizons through field experience and an internship.

Eventually, I finished my PhD and did a postdoctoral degree in industrial engineering at Laval University in Quebec, Canada. After that, in 2008, I was appointed as a professor in Morocco. Here I felt much more supported compared to my study period, but the gender wage gap has remained an issue.

I even know that the university where I work applies a salary sliding scale that shows gender discrimination and systemic biases in many other criteria. No salary grids have been made public, however, even after various professors called for more transparency.

The best coping strategies are resilience, self-motivation and self-control.

No one will deny that engineering is an exacting field, especially at

the start of a university course. There is often little time to socialise, and a heavy workload. You can accumulate a lot of stress and sometimes question your study choices.

You need to be rigorous and disciplined during this time to push through. Believe in yourself and encourage yourself. This is what I always tell my students, as I myself did when I embarked on this journey.

Perseverance is key to becoming a successful engineer. The resilience and self-reliance you develop in your undergraduate years will stand you in good stead for life, no matter what you face. It is the time when you move from being a child to becoming an adult and taking care of yourself.

Stay strong by remembering that everything is temporary and fluid – bad times never last. You must be adaptable and work through failures to achieve success. Failure is inevitable. It is something we all face, but it is how you deal with it and move beyond it that defines your true path. Challenges are simply learning opportunities!

Work/life (im)balance?

Another noticeable challenge today's working women face is an imbalance between work and private lives. Because of job obligations or vice versa, your private life often suffers. After endless evenings at the office to finish an important project, the family tends to feel neglected. This puts an immense strain on women juggling so many balls at the same time. You need to be strong and focused to survive this – mentally as well

as emotionally.

On the other end of the spectrum, females are still in the same impasse because they have to leave the job on time to pick up their children from after-school activities. Unfortunately, this is sometimes self-inflicted – we need to organise our time better, get help and get our priorities in order to lead a well-balanced life.

On a practical level, I think more workplaces have to be equipped with crèches to accommodate women who want to breastfeed and see their children during the day. The women can then stay productive, without having to disrupt work projects, which will contribute to managing employers' as well as employees' expectations. I can see to what extent my dedication in education is rewarded by the great impact on my students' life and career.

Passing on the torch of knowledge

My passion for education and love for my family would even lead me to teach for free and discard all these issues. I still strongly believe that value-adding work gives a person the greatest self-value. To transfer one's knowledge to each new generation is a noble and honourable vocation and I am proud to be a teacher and leader.

Our world is changing so fast that we need to be the keepers of the old ways, even as we adapt to technological and industrial advancements.

I love what I do. I am truly blessed, with a passion to keep learning and exploring.

JOURNEY 6

ADDRESSING FATE, REDRESSING IMBALANCE

Enyonam Fafa Aku Kpekpena
*Manager/IT Projects Delivery &
Programme Management Office
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GHANA*

A particular talent for science

I was born in the central Ghanaian town of Agona-Swedru, but spent my formative years in Tema, one of Ghana's coastal cities. My family consisted of my late father, Seth K. B. Matanawui (a lawyer), my mother, Josephina Armah Matanawui (an agricultural officer), my three sisters and I. I was the second-born.

From an early age, I displayed a heightened sense of discipline, responsibility, confidence and open-mindedness. These qualities have served me well in both my personal life and career. From the outset of my schooling career, I loved science and had a particular talent for it. I did consistently well with each consecutive year. I felt great pride when I won

prizes at our award ceremonies. It seemed my path was clear.

Academic achievements encouraged me to soar higher. I became one of the few students from my town who obtained a distinction in the common entrance examination for admission to one of the most prestigious high schools in the country, Achimota Secondary School. This school counts past

ABOUT THE AUTHOR



Dr Enyonam Kpekpena is information and communications technology (ICT) project manager and programme management office lead at the Electricity Company of Ghana (ECG). She currently also serves as deputy vice-chair of the female leadership and empowerment theme for the Women in Engineering (WIE) committee, which forms part of the World Federation of Engineering Organizations (WIE-WFEO), and serves as deputy chair of the WIE committee of the Federation of African Engineering Organizations (WIE-FAEO). She is on the nominations committee of the Ghana chapter of the Project Management Institute (PMI).

Enyonam is the founder and first president of the women in engineering (WinE) chapter of the Electricity Company of Ghana (ECG - WinE). She obtained her bachelor's degree in electrical and electronic engineering from the Kwame Nkrumah University of Science and Technology in 2000, where she specialised in telecommunications and computers.

She holds a master's degree in management, with a specialisation in information technology (IT) and project management as well as a PhD in management from the Colorado Technical University. Her research interests include IT project management, project performance management and earned value management.

Her career spans local and foreign markets, with over 15 years working in various management roles in the sector.

presidents of Ghana among its alumni, so I knew I had done something right!

My time there began on a great note. I immediately got involved in athletics while maintaining my excellent performance in science and my love for the subject. My mother was especially supportive of my dedication. She was a science buff herself and I had always admired this – in fact, she was my first active role model.

Trusting your instincts: art vs science

Just before school reopened one year, I had to make a choice around subjects for the coming year. My mother had left the country to do a course and my father convinced me to change my focus to the arts. He wanted me to follow in his footsteps and choose subjects that would allow me to study law.

I battled with this for some time and finally agreed that he should go with me to make the change at the school. I felt deeply uncomfortable, although I could not openly express this to him.

We made the change before school reopened, but I started the term with doubts in my mind. I was not convinced that I had made the right choice. I attended a couple of the arts classes, but my gut instinct led me to switch over to science. This was not an easy decision, but it felt right and I have no regrets. It was the right thing to do.

My father thought I had just become a victim to a school trend, but for me it was an authentic choice. I flourished in other pursuits as well. I became a prefect and was given my first award as “the best-behaved student with leadership qualities”. I distinguished myself with excellent grades in

the GCE O-level and A-level examinations and obtained admission to the only institution that offered engineering in Ghana at the time, the Kwame Nkrumah University of Science and Technology.

I am a hard worker and a confident person. This has formed my path.

From a tough start to all-round success

I was one of seven females admitted to the electrical engineering degree class of 46 students. As soon as I started the engineering programme, I realised it was going to be tough. I spent most of my time learning and having group discussions with my fellow students.

Most of the lecturers at the time were not too friendly with the female engineering students and seemed ready to prove that women could not do engineering. Because of this, we had to go the extra mile to ensure that we scored high marks. We worked harder, and as a result performed well!

I soon learnt to persevere, especially when I needed to understand the complex and abstract aspects of the subject. I also realised that because we were the minority, engineering women needed to be strong-willed. Fortunately, I am that, and I remain so. I am no pushover. My inner confidence spurs me on.

It wasn't all work and no play, though. I was a university athlete and participated in the interuniversity cross-country race for two consecutive years. I also joined the interhall Christian fellowship on campus and developed my Christian ministry in child evangelism. These extracurricular activities helped me to develop excellent time management skills and taught me the value of a well-balanced life.

Work life and marriage

It didn't take long for me to become gainfully employed. I got my first job before I completed my final year at university. This was through a selective recruitment process that the company organised on campus and I was among the students who performed well. I worked for two years before deciding to pursue a master's degree. At the same time, I fell in love with my husband. We tied the knot two years after I completed my undergraduate studies.

I always say that I am lucky to have married a supportive man, because he made sure that I pursued my dream and ensured that marriage did not become a stumbling block for me. He helped me during the laborious process of obtaining admission to pursue a rigorous master's degree at a university outside the country. I believe it helped that he too is an engineer and understands the pressures of our industry.

With much determination, commitment and perseverance, I gained admission to do an MSc degree in information technology and project management at the Colorado Technical University in the USA. I did not have a scholarship and had to combine numerous odd jobs to pay my tuition fees. I worked in technical support while completing my graduate studies. I really learnt to hustle and multitask!

My part-time work made me acutely aware of the realities in the marketplace as opposed to more abstract academic research. This blended interest in research and management also helped to lead me into IT and management consultancy later in life. It shows you that nothing happens

by chance and every experience is an opportunity to learn, grow and adapt!

Pay up!

One day I got a call from the international student advisor after my fees had piled up because I lost one of my odd jobs. I was gently reminded that I would be deported to Ghana within a month if I did not pay my fees. I was frightened and stressed.

Just as I was at the point of giving up, help came through the generous support of my dear husband. His financial support was really extraordinary and exceptional, as was his belief in me, especially as we were maintaining a long-distance relationship.

We did it. He stepped up and continues to do so. I successfully graduated with an MSc degree in management, with majors in information technology and project management, before travelling back to Ghana to work and settle down to make a family with him.

Discrimination continues

Back in Ghana, it was difficult to secure a job and I had to wait almost six months before I finally got employed at the electricity company of Ghana where I work now. At that time, God also blessed us with a son, who is now 15.

I faced a major challenge immediately after I got employed because the company did not engage me based on the master's degree I had acquired. They put me at a level below my colleagues, despite my academic qualifications and vast experience at both local and international levels. I was placed at the entry level for anyone with a bachelor's degree and that

was very problematic. I felt frustrated and discriminated against. Despite this setback, I accepted the job and applied myself diligently to my work.

Proposals and promotions

I looked out for opportunities that became available for training and promotions. I quickly realised that there was a glaring deficiency regarding staffing levels in the IT department and worked with my manager to write a series of proposals to have the problem resolved. Following this intervention, several senior positions were advertised and I decided to apply.

I was invited and attended all the interviews to ensure that I was at least considered for one of the positions. This is where I faced the greatest challenge at work. I was informed that even though I was well-qualified and successfully passed the interview, I could not be promoted because someone on the level of assistant electrical engineer could not become a senior electrical engineer without first working on the electrical engineer level.

At this point, I realised that I would never be treated fairly in this work environment. With my husband's input, I wrote a petition to the managing director, motivating my suitability for the more senior position. My petition was accepted and I was finally promoted, but had to remain at the electrical engineer level for a year before rising to the position of a senior electrical engineer. But I pressed on.

Continuing to rise

In no time, my immediate supervisor, realising that I possessed exceptional management skills, decided to hand over the management of

the IT support section to me before his retirement.

After a year, some internal managerial positions were advertised and one of the qualifying criteria was to be at the senior level. This meant that I would not have qualified for a managerial position if I had not petitioned and had my issue resolved at the time that I did.

I finally got promoted to a managerial level. I realised that all through my career, rising to the next level had been difficult. Even though I did well in all the interviews I attended, male counterparts who did not have the same work output were promoted ahead of me. I am still battling with this challenge. It was during this time that I decided to pursue my doctoral studies.

Family ties and doctoral studies

My father's sudden death at this crucial time was devastating and came as a great blow. It made me suspend the application process. I was required to submit a PhD proposal and writing it was not easy under the circumstances of my bereavement. It was only after my father's burial that I decided to further pursue my application after I managed to complete the proposal for consideration. To my amazement, I obtained admission to do a doctoral programme in management at the Colorado Technical University in the USA.

I followed the advice of my husband and put in an application for financial support from my company. I followed up with a visit to the HR director, explained that this was a rare opportunity that I needed to take advantage of and noted that the company would also benefit in the

long run. I explained that I would continue working while studying. My application was approved, with my company agreeing to pay 14% of the cost of the programme. The company also agreed to fund all five trips I had to undertake to attend doctoral symposiums as part of the course. This was a great validation.

All of this was amazing and I am still so thankful to God, my supportive husband, my company, mom and sisters for always supporting and encouraging me in my studies and career. I worked so hard and had numerous sleepless nights during my doctoral programme.

I also had to take care of my mother-in-law and sister-in-law, who had health complications at this time. Unfortunately, we lost them both within a period of six months. It was tough on our family, but we prevailed.

During the three-year-period of my doctoral programme, there were so many difficulties which could have made me give up along the line, but one thing I learnt from my professors and advisors was to keep going. I am so proud that I did.

I encourage all my female colleagues to press on and not fall back at any moment of their lives. They should always look for opportunities to rise to leadership positions, strive to make it and never lose sight of great networking opportunities.

Once we are convinced that we are doing the right thing, we must approach it boldly and always state our case, making sure to document

our issues, challenges and ways we have used to seek redress. Never accept being cheated in life.

A little bit about what I do

Currently, I work as information and communications technology (ICT) project manager at the Electric Company of Ghana. I am also the programme management lead for the Programme and Change Management Office for ECG's Financial and Operational Turnaround Project (EFOT). It is a \$225 million project financed by MiDA, an advisory firm that facilitates institutional investments and trade in emerging markets such as ours.

As management lead, I ensure that all projects in the EFOT portfolio are professionally run. This includes IT projects as well as infrastructure projects such as bulk supply points (BSPs), primary substations and low-voltage network redevelopment and reinforcement. I enforce compliance with professional project management structures, processes and procedures in all the projects.

A proud achievement

Just prior to my current role, I managed the highly successful technical assessment of assets (TAA) project, in which we captured all ECG's medium- and high-voltage real estate and a large percentage of the low-voltage electrical assets from scratch into an electronic database in a record time of under two years.

This is something I am extremely proud of. Asset attributes captured

under this project include technical specifications, connectivity, location (GPS coordinates) and condition of the assets – all essential input into distribution service tariff proposals to the Public Utilities Regulatory Commission (PURC). It was a huge undertaking and an enormous success.

The data from this project is now readily available to every staff member who requires it in an easily accessible online format. It is used all over ECG's regions for planning, design, line extensions, asset management and even for bush-clearing contracts. The data has also been migrated into the GIS system that is being implemented under the EFOT programme.

In managing this project, I had to supervise our technical advisors and a team of 150 ECG permanent staff and approximately 400 contract staff and national service personnel. I coordinated their recruitment, sometimes directly organising the interviews, remuneration, transportation, daily work schedules and their reporting.

I worked with all the departments in ECG, from head office to the regions and districts, to make sure that the project was completed on schedule and achieved its stated objectives.

I managed this demanding project at the same time as I was completing my PhD. I combined knowledge from the doctoral programme with advice from technical advisors (consultants) to establish programme management structures, including governance, monitoring and control processes for effective project management.

The TAA project was so successful that I became the natural candidate to lead the ECG PMO when it was formed in 2019. It's wonderful when hard work leads to career success and acknowledgement from one's peers.

Keep going, keep learning, keep sharing

My life experiences have taught me that everything is achievable with dedication, persistence, hard work and commitment. My aspiration remains to become a seasoned consultant in programme management to be able to successfully deliver innovative products to transform Ghanaian society. To this end, I continue to encourage, counsel, mentor and guide students as well as young professionals.

I encourage all my female colleagues to press on and not fall back at any moment of their lives. They should always look for opportunities to rise to leadership positions, strive to make it and never lose sight of great networking opportunities.

Once we are convinced that we are doing the right thing, we must approach it boldly and always state our case, making sure to document our issues, challenges and ways we have used to seek redress. Never accept being cheated in life. We must raise ourselves up, and by doing that we can raise up others!

JOURNEY 7

BECOMING SISTERS TO MEN

Ndèye Ndiaye Cissé Lakh

Electromechanical Engineer & Executive

MBA International Paris, Founder and

Manager at ADDExx Consulting

SENEGAL

Work together and keep developing for a brighter future

My name is Ndiaye Cissé and I see myself first and foremost as an engineer. I believe that people should always work to keep developing themselves. We should see our weak areas as opportunities for growth. I see the beauty and strength of both men and women and how well we can work in tandem to build a brighter future for tomorrow's generation.

I was born in Dakar, the capital city of Senegal in West Africa, in January 1980. I spent my entire childhood there, while often visiting my father's family, who lived over 200km away in a remote part of the country. I loved those trips, as I got to see wild and fascinating places and the different way of living in the rural places. It was exciting and eye-opening.

I was the 13th-born out of a brood of 14 and was very attached to my

father and older brothers. I used to be with them all the time, watching football, playing video games, developing dexterity and reading cowboy stories.

I loved reading and actually dreamt of becoming a novelist. I even wrote a romance in French when I was a teenager. I showed it to my father who, while impressed, I think found it a little precocious. He said, “My dear daughter, this story is enjoyable, but it will be for the best if we do not have it published because you are still very young.”

I hope to return to writing again one day.

ABOUT THE AUTHOR



A former resident of Senegal's state school of excellence (Mariama Bâ Boarding School, Gorée Island) and an electromechanical engineer with a first-class honours from the reputable Thiès Polytechnic School in Senegal, Ndèye gained solid practical experience at the large multinational oil company Shell and thereafter with Vivo (a Shell licensee in Africa). At both operations, she served in extended leadership teams at national level.

Ndèye has competencies in health and safety, security and the environment, supply, road transport, quality auditing, management and leadership, gained through her tenures at Shell & Vivo and also through Trainings from PECB, SGS, the British Council. She holds an executive MBA from the Paris 1 Panthéon Sorbonne University and Paris Dauphine University a master's in management and organisation from Paris Dauphine University.

Ndèye successfully launched her own consulting business, ADDExx Consulting, in 2019 and today she offers to boost companies performance by helping leaders and managers implement constructive change such as launching new activities, enlarging business perimeters, improving processes and reorganising activities.

A big, happy family of smart people

My father was a teacher and much more – he was a truly brilliant man. From nurse to civil engineering technician, from author to university professor, from inspector of national education to cabinet director of the Minister of Education, he did it all. What a role model he was! When educating children, he made no difference between the boys and the girls. What mattered to him was what you were capable of doing intellectually. He believed men had to be open to women and respect them. He treated us all equally in our pursuit of knowledge, for which I am most grateful.

I come from a polygamous family. Our moms educated us with love and prayers and were supportive of all of us and one another. They wanted us to be successful and become the pride of the whole family. We all loved each other and worked together for the greater good of the unit.

One of my brothers was a bit of a genius, always doing experiments and building things. When he was around 13 years old, he was already capable of creating and transmitting radio signals with a homebuilt transmitter. In the morning he often spoke about electronics and showed us the discoveries he made during the night. I was around nine years old then and became entranced by his experiments. It was great growing up with so much stimulation around me.

A life-changing aeroplane trip

At 11 years old, we went to the south of Senegal to visit one of my aunts. It was a great trip, as we crossed the Niokolo Koba National Park and saw wild animals next to us while driving in our car. What an unforgettable

experience! It was also an arduous road trip, and my elder sister and I fell ill during the holidays, so my father decided to let us fly back home.

This was our first time on an aeroplane. It was a great experience, apart from the droning sound of the plane, which was a little one with only a dozen seats. I was not so confident in that piece of metal in the sky! I was thinking about the plane having some issues with the rotor and imagined what would happen if that was the case ... But we arrived safely, and I was amazed by what aeroplanes could do.

Prestigious schooling on Gorée Island

Less than a month later, I entered the Mariama Bâ Boarding School (Excellency School of Girls) on Île de Gorée (Gorée Island), just off the coast of Dakar. This prestigious all-girl academy was established by the Senegalese government in the memory of one of our country's well-known female authors. Occupying old barracks of the French Army, it was regarded as not only the last female boarding school in Senegal but also as a historical centre for educating the best and brightest Senegalese girls.

We were around 30 girls for our promotion in 1991 and we all had to say which profession we would like to embrace in the future. My response was, "I want to become an aeronautical engineer or mechanic for aeroplanes."

It is so amazing that while I'm writing the story, I can say I made that dream come true by being a mechanical engineer! Entering the STEM field was one of my dreams from early on in life. Throughout and after my studies I continued to develop new skills and knowledge in tandem with attaining an engineering diploma.

I believe it is critical to be an all-rounder as well as a lifelong learner. I ended up establishing a consultancy business to support others, to develop their skills and to transfer my own knowledge and experience, in line with the team spirit I developed from a young age at school.

Choosing the right career

At the beginning of my career, I did not want to choose between family and work. It made sense for me to pledge my commitment to both, even if it meant I would evolve more slowly and progress more gradually in my career. I wanted to start a family and have children while working as an engineer and I have been able to do it because I had the right attitude.

I knew I could have the best of both worlds if I managed things carefully. My father educated us in this spirit and at no time did anyone in my family contradict this. One of my sisters also went into the STEM field. So did my future husband, who also assisted me in the first year of engineering. And yes, we fell in love like that!

Tertiary education at Thiès

After high school, I applied to and was accepted at the Polytechnic School of Thiès, Senegal's top engineering university, to study electromechanical engineering. There were only three female and 36 male students in my class.

This was a record, as usually it was a male-only course. I am proud to say that the women were welcomed by our classmates. There should indeed have been little doubt that we could succeed in the mechanical branch of engineering because it was a rigorous selection process and we had already proven ourselves by being accepted. We were therefore supported and

accepted into working groups. The campus had other women from other STEM studies and we all shared our facilities with the men.

On one occasion, we came to the campus to have a look at the admission results and heard something like we were not going to pass. It was quite shocking to hear that and it was so demotivating. However, I saw this as a challenge to prove that women were capable of success.

Five years later, I was in an amphitheatre full of graduates, receiving my degree from the Ministry of National Education, and it was a first-class honours qualification!

The entire room, filled with hundreds of people, men as well as women, applauded. It was a proud moment, not only for me but also for my parents and the rest of my family. The challenge had been accepted, and thanks to the Almighty I had succeeded in what I had set out to do.

Into the field

After finishing my engineering degree, I convinced my father that I would start my career immediately, before pursuing studies again, so that I could see what the working environment was like and which skills I could develop for the future. I began my engineering journey by doing an internship in the national chemical industry.

I enjoyed it very much, as I learnt a lot and had the opportunity to do manual things like maintaining and manufacturing mechanical equipment. I got to be on the ground and learnt by observing and doing but also asking a lot of questions.

Even if I did not feel that I had to prove something in order to be

accepted, the fact that it was not that common to see women in this domain somehow pushed me to do things correctly so that I could harness credibility. Doing this also boosted my self-confidence.

Go well go Shell?

Shell in Senegal recruited me after my graduation. It was quite challenging, as I started quite young (I was barely 23 years old) at a multinational company in the oil and gas sector. The risk associated with the operations was quite high, and I had to learn much from senior colleagues who became my trusted mentors.

I had to develop the courage to stay on and not give up, to learn and to do what was correct without fear. Today I can look back and see that young, unseasoned woman, going inside emptied hydrocarbon tanks to perform gas tests and liaising with the workers, all of whom were men! I was literally the only woman on site.

On some days there were hundreds of workers doing different jobs and I was the manager in charge of it all. The company, however, trusted my skills and gave me the opportunity, as a young Senegalese woman, to prove what I could do. Thanks to hard work, my can-do attitude and a large dose of perseverance, as well as my colleagues and brothers who helped me, I succeeded in my first managerial role!

Working in a challenging environment contributed positively to my early career and helped me to develop my resilience, strength and sense of professionalism. It was a real gift. My family was proud of my success in the engineering field, especially at a multinational company.

Work, life, love

When I started working, I also wanted to marry my future husband, the supportive man who helped me during my studies and who also went abroad to continue his engineering studies. It was not a simple decision because I was still in the formative period of my career and needed to be dutiful. At the end of the day, however, everything went well and being married gave me a sense of upliftment and balance.

Being a woman in engineering, and someone who worked for a multinational corporation, reinforced my status in a positive way. It was not that common and the field of engineering, especially the mechanical leg, was seen as one of the toughest career choices.. Every woman who was capable of succeeding in the field was respected and became a source of admiration for others.

I am proud to say that my work environment remains diverse. It consists of men who accept being led by a woman, and a lot of this has to do with age and seniority. The local culture shows respect for older people and even if it is changing little by little, it still exists here. Now that I am older, I have respect for different reasons than when I was young and had to prove myself.

There is no room for prejudice in the modern workplace. It works for me to be aware of this and to extend a sense of humanity and recognise merit, as I try to maintain good relationships with my colleagues. Such actions and attitudes contributed much to my personal development and

sense of maturity. You must transform every challenge and weakness into an opportunity to build strength and resilience.

When I started working, I did not feel unsafe thanks to the example my family set. I asked many questions so that I could learn and integrate myself into the new working environment. In my view, every day was a new beginning and I had to prove to myself that I was capable of fulfilling duties and leadership roles. It made me feel competent and confident that I could bring something valuable to the table.

At the end of the day, it is important to me to ensure that I remain professional but also committed to my family. My husband and I take care of our children as a team. The STEM field has taught me important principles such as organisation and safety, and I also apply those at home.

Being in such a methodical work environment actually contributes much to my family's wellbeing and that of our home environment. In turn, my family cares a lot about me being a dedicated mother and an equally dedicated worker. I get to enjoy the money I earn and spend time with my husband and children.

To the female engineers of tomorrow

One thing of cardinal importance that I have learnt is that to survive in a male-dominated work environment, you are only as strong as you are intellectually committed. It is important to think carefully, creatively and analytically. This does not mean compromising your personality as a woman.

After all, diversity contributes to performance. So, remain a woman. You do not need to masculinise yourself to be respected.

In general, I believe that encouraging women to gain knowledge and skills in sciences can help countries in their development process. Knowing that a large part of our youth is composed of women makes this a top priority. They have to become sisters of the men, especially in the engineering and wider STEM field.

Hopes for the future

One of my big dreams is to see strong women promoted without discrimination. Competence and engagement are important criteria. Women may have different leadership styles and employ different methods, as long as they add value to the company. They should not fear success and be willing to improve. They also need to be well-organised and successful, no matter how many children they have; they must be committed to their work and achieve assigned targets.

In my day-to-day activities and on social media I encourage women and young people, including those in STEM, to build confidence and always believe in themselves. I act and share stories like a role model to have a positive impact; this is another way of applying the leadership concept of leading by example.

It can be hard to choose the right path going forward. I believe, however, that with true belief and perseverance, you can achieve your dreams and

become a better version of yourself, even if it is little by little. I also put a lot of faith in people's wellbeing. In fact, for me the most beautiful part of the history of humanity is how a sense of community developed.

During my life I have tried my best not to be selfish and to help others, just as they have helped me. The truth is that you cannot succeed being lonely or living in a vacuum. We need to come together more and realise that together we are strong. Let us make brothers of men and let them make sisters of us and build a better world together.

JOURNEY 8

CREATE OPPORTUNITIES BY USING WHAT YOU HAVE

Charlette N'Guessan

CEO of BACE Group

CÔTE D'IVOIRE

Life in busy Yop City

My name is Charlette N'Guessan. I am a 27-year-old Ivorian. I grew up in Yopougon, affectionately known as Yop City, a busy suburb of Abidjan, the capital of Côte d'Ivoire. My parents got divorced when I was in primary school. This led to a challenging period in my childhood, although my parents still tried to build the best life for us. I have five beautiful, smart sisters. I always look at my big sisters with admiration because they set an example for me – to work hard and excel at school and in all other pursuits.

I have always seen my mother as a good and strong businesswoman. She owned one of the most popular public vending spaces in Yopougon, working as an informal trader and street food vendor. She remained in

the industry for more than 20 years, which I always found amazing and inspiring. It was a male-dominated ecosystem, but she just got in there and did her thing. This has made her an excellent role model for us six girls.

As a mathematics lecturer, my father always promoted excellence in the house, so we did not have a choice when it came to doing our best and achieving good academic results. It was expected. He was also passionate about architecture and used to draw a lot of building plans. I believe he

ABOUT THE AUTHOR



Born on 16 December 1993 in Abidjan, Charlette N'Guessan is an Ivorian who took her first steps in the tech ecosystem after obtaining her scientific baccalaureate. Today, Charlette is a graduate in electronics and software engineering and certified in data science with a particular enthusiasm for AI/ML models. She is also a certified digital identity practitioner and co-author of *The AI Book* (published by Wiley in April 2020).

Passionate about using technology to solve local challenges, Charlette began her entrepreneurial career in 2017, being the first French-speaking woman to be selected to join MEST, the prestigious school of technological entrepreneurship based in Ghana. In 2018, she co-founded and became the CEO of BACE Group, a tech startup that provides AI-powered facial recognition services for online identity verification and AI consulting services.

Charlette is a tech entrepreneur who collaborates with various organisations that strongly advocate for gender balance in the tech ecosystem. She believes in the potential of African youth and is the first woman to win the Africa Engineering Prize awarded by the Royal Academy of Engineering. She has also been recognised as one of the 100 Most Influential Young African Leaders as well as one of the best AI leaders to follow in Africa.

was the one who designed the plan for our house. As a child I was close to my father and I developed a shared passion for architecture, drawing just about everything I saw. I still believe that if I were not in the tech industry, I would have become an architect.

Some people would say that my father being a mathematics lecturer at one of the local universities gave me an advantage, but I have sisters who are not that good at mathematics, so that disproves that theory. I had no idea that I would one day obtain a software degree and start my own company as a young woman. When I was in high school, I performed well in mathematics and everything science-related, but the way things turned out was not the result of some plan I made. It just happened!

Expectation versus reality

Like most little girls, I played games that had been designed for girls. From early on, we were made aware of the differences between ourselves and boys. There was however little difference in our education. My parents tried to make us understand that professionally we could have the same chances and that we should not limit ourselves. I have been lucky in that respect.

My dad used to say that we had to think like men in order to achieve something. At that point, I believed that if I thought or behaved like a woman, I was not going to be smart enough or get far in life. So I was a tomboy. However, I have realised over time that this is a picture that society wants us to believe: a successful woman must have a masculine mindset. This is very wrong! As women, our intelligence has nothing to do with our

gender. I am happy to have dispelled this myth for myself as I grew older.

I expected to go to university and study architecture, but the best schools that offered architecture courses were quite expensive. At that stage, my parents started having some financial issues, so were not able to afford the fees. This hard-hitting reality affected everyone's plans. It was a bitter pill to swallow, but it turned out for the best.

The tech ecosystem

I have always been good at science, so it was obvious that I would end up in a science-related career, but I only realised this fully after my second year at university. I was curious about technology and explored its opportunities. At the same time, my passion for this industry was growing and I improved my skills by learning. I was growing confident about the idea of becoming a tech entrepreneur.

I finally went to Yamoussoukro (a city in Côte d'Ivoire) for two years to do a degree in computer science and electronics. I spent a whole year looking for opportunities, scholarships, internships and jobs to pay for my tuition. Finally, I got an opportunity to join a tech lab as an intern and slowly became integrated into Côte d'Ivoire's tech ecosystem.

One thing that stood out for me and left an impression was the gender gap in the tech sector as well as how many challenges local people had to face to be granted access to opportunities. I began blogging about my journey as a woman in tech and also shared information about opportunities related to entrepreneurship, leadership and technology, with a focus on Africans. I worked with tech communities that promoted the use of technology and I

started to collaborate with various NGOs (non-governmental organisations) that strongly advocated gender balance in the tech world.

Closing the gender gap in tech

I noticed the gender gap in engineering early on. From high school to university, the number of boys outnumbered girls. During my first year at university, only about a third of the class were women. I was a good student in university and the lecturers often used me as an example to pressure my classmates into working harder. But I always felt that they did not really expect me to be as good because I was a woman.

I started my technological entrepreneurship journey after my third year in engineering. I could not continue my university studies for financial reasons. Instead, I continued to learn using scholarships and got certifications in data science. One day I want to be able to pursue my studies at university, get an executive MBA in artificial intelligence (AI) and a master's in machine learning (ML), and then focus on research. This is my current goal on an academic level, but I have many other dreams too.

What then is engineering?

What is engineering exactly? For me, it is a broad term for people who apply problem solving, analytical and entrepreneurial skills, and have a command of science and maths in order to design and create systems. In this sense, you can also engineer your life by solving problems and overcoming obstacles, as I have.

When I studied software engineering during my third year of university, I was amazed at how we can use technology to innovate and solve problems

in different industries. I started to research software solutions and blogged about them. The more I learnt, the more my interest in launching my startup and becoming a tech entrepreneur grew.

In 2017, I was invited to attend the Young African Leaders Initiative (YALI) in Dakar, and work on my business ideas. After six weeks in Senegal, I came back with only one goal – to become an entrepreneur and solve problems using technology. I was becoming a self-made software engineer.

BACE Group: how to combat online fraud using AI

In the same year (2017), MEST (Meltwater Entrepreneurial School of Technology) came to Abidjan to recruit Francophone people from Côte d'Ivoire to work in the sector. I applied and became part of the first group of French speakers in the programme, where I was the only woman. MEST gave me the opportunity to move from Côte d'Ivoire to Ghana and get involved in a different ecosystem, learn English and leave my comfort zone. It was a scary but highly worthwhile move, and it opened up my world and a realm of opportunities that I was ready to seize.

This was where my journey as a co-founder of the BACE Group started. My company co-founders and I had similar interests and ultimately, after studying gaps in the Ghanaian market, we decided to find a way to apply tech to the financial services industry.

According to the World Bank's ID4D programme, more than 40% of people without official IDs live in Africa. This lack of identity excludes the population from basic services such as access to financial services, voting rights and education. For this reason, we decided to focus on online fraud

because the existing knowledge-based authentication solutions used by financial institutions were not effective. We understood that providing identity documents to prove who you are was no longer enough, because these documents could be duplicated and used by fraudsters.

In September 2018, we officially launched our startup and invested our time in the product development building of BACE API. Powered by facial recognition and AI, today BACE API helps companies monitor fraudulent online activities in real time, cutting costs significantly. BACE solves challenges locals face, such as identity theft, financial exclusion, mobility and cybercrime. We are helping service providers and consumers simultaneously, which is very gratifying.

Woman in a man's world

My journey as a female tech company founder in an industry dominated by men has been challenging and wonderful at the same time. As with most female entrepreneurs, I've been in situations where I felt disrespected and discriminated against by other entrepreneurs. Some indecent propositions or the feeling of always proving that you deserve sitting at a table predominantly occupied by men have been challenging. My fight against imposter syndrome has been tough, as have all those nights I spent overthinking my own abilities or perceived lack thereof. But I am learning to trust myself more and more!

Most of the time people ask me how I manage to lead a team of men. I always say, for my own part, I feel lucky working with men who understand that technology does not know gender or level of contribution based on

gender. I value education and training, and strongly believe that women need to invest in their education to become experts in their domain. That is one way to feel confident and make progress in a competitive industry like engineering.

Never stop learning, even beyond formal training

Another solution is to never stop learning and exploring, experimenting and creating. We all need to find opportunities that will contribute to our learning journey. For example, when I started my business, I knew that because technology keeps changing and advancing, I needed to work hard to keep up with this rapid evolution. My way of keeping abreast of things was, firstly, to attain certification in the digital identity related to my work. I then received a scholarship to get certified in data science (Python and machine learning). I attended, and keep on attending, a lot of online courses related to my work. I instinctively knew that the more I was learning, the more I had something relevant to say. Through this, my professional credibility and insights became more attractive to potential clients.

I know that education requires time and money. Like some of you, I wished to have enough money and attend reputable schools. But because I did not have this, I managed to define a strategy and searched for affordable opportunities that contributed to my education. It is still an investment.

Sharing is important to me. Being involved in the technological ecosystem, I have been involved in numerous collaborations and contributions to local and international organisations. One of the contributions that made

me extremely proud was to be a co-author of an AI-focused book published by Wiley in April 2020. It has been an exciting project and a collaborative effort. I was the youngest and the only black co-author, writing about the opportunities of AI in the financial sector in Africa.

Trust me, once you qualify and reach a certain point, you do not have to look as hard for opportunities – instead they seek and find you!

Recognition from peers

In September 2020, I won the Royal Academy of Engineering's prestigious 2020 Africa Prize for Engineering Innovation. I am the first woman to win the prize, and the first winner based in Ghana and from Côte d'Ivoire.

Can you imagine what I felt when I received this recognition? I was extremely proud of our company's work and of myself. I remember how impressed I used to be when I read about people who had made history through their work. I had always wished that one day I would google my name and read something amazing that I accomplished. Now I have contributed to STEM by opening the door for women engineers who want to apply for the Africa Prize. Hopefully by inspiring little girls with this journey, I can also make a difference to society.

Aim big, invest big, grow big

Today, I have more confidence in the future. I know how powerful a positive mindset is. If we settle for little, we will invest little and stay small in our minds, lives and careers. If we aim big, we invest big and grow big.

The secret of success is us. Nothing else. We are who we choose to be and choose to become.

I see myself as having a responsibility to inspire other women and be an aspirational example. Yes, people have their own opinion on women in engineering. Some see us as 'female men', but we're not. We are women who are gifted in a certain field. Organisations often do not trust women, although they claim to do so. In most of the organisations I have worked with, I was the first woman in their IT department.

Luckily things are changing and I have seen opportunities that encourage women to come forward. My role is to open more doors for women and motivate them to invest in their education. I pray that I'll be able to keep on inspiring them with my work.

We need to understand that engineering is not about gender, but about skills and passion. We need to start promoting what matters – good minds with great aspirations and positive intentions.

JOURNEY 9

PAVING THE WAY FORWARD: MOVING UP AND REACHING OUT

Widad Yagoub Ibrahim Osman

Vice-chair of BEE

Construction and Petroleum

SUDAN

The gift of never having your wings clipped

I was born in 1959 on a small poultry farm in a rural area just north of Sudan's capital, Khartoum, to two hard-working parents. My mother and father, who were exceptional and unique pioneers, have shaped me into the woman I am today. Becoming an engineer would not have been possible without their encouragement and support. They never clipped my wings. In fact, they taught me how to fly! I credit my achievements in all other fields to my engineering career, which has taught me to be a critical thinker and a meticulous problem solver. I am both a dreamer and a doer.

My father, having been an orphan, was a resilient, brave and responsible man who was serious about education. He strongly believed in the capabilities of women, and their right to education and equality. This is an important

foundation that every girl should have. My father became a teacher, he educated himself and in 1968 he was promoted to the position of general manager of the Agricultural Bank of Sudan. Perhaps this is part of the reason I later also established a bank, as I was inspired by his example.

My mother, Radiya Hussein Elsayegh, was a remarkable woman, a farmer and a popular poet. She was passionate about education and always

ABOUT THE AUTHOR



Widad Yagoub Ibrahim Osman was born in 1959. She holds a degree in civil engineering from the University of Khartoum. Widad founded BEE Construction in 1985 and co-founded BEE Petroleum with her husband in 1993. It is currently Sudan's only privatised oil and gas distribution enterprise, and the first company to use automotive LPG in many African countries. Widad serves as vice-chair and has also been the general manager. In 2006, she founded the Sudanese

Family Bank.

Widad is an active member of the Child Development Foundation (CDF), which she founded in 1999. The CDF looks after children affected by war in the region. She has also served as a board member at several universities, including the University of Khartoum, the University of Sudan, Dongla University and Suba University. She is part of the Arab Businesswomen Union and is the vice-secretary-general of the Sudanese Business Owner's Federation.

She has garnered several accolades over the years, including an award for social responsibility (the Golden Shield of Excellence to distinguished women in entrepreneurship from the Arab Women's Council & Arab Organisation for Social Responsibility, in October 2015), and holds an honorary doctorate in sustainability from UNESCO.

She is married to Dr Gamal Eldin Osman. They have six biological children and 34 adopted children.

encouraged her children, nieces and nephews to continue their studies. She was awarded by the UN for her efforts in poultry cross-breeding in 1964. She was also a talented poet and one of her most recognised poems encouraged women to work hard and create their own projects. It was often read on radio programmes. Although my mother had limited formal education, she was a dynamic person, and dedicated to supporting her immediate and extended family as well as the wider community.

Give respect in order to receive it

My siblings and I had a fulfilling and adventurous childhood, and my parents instilled in us a unique outlook on life. Communal living and equality coloured our upbringing and we all had an active role in managing the farm. My parents' advice has helped me overcome many obstacles. They told us to never respond to ignorance and always remain calm. "Just look forward and march on straight," they used to say.

These words of wisdom resonated with me my entire life, and they are the same words that echo in my head when I am faced with any challenge in life that involves people undermining me or discriminating against me because of my gender, beliefs or race. These are also the words that give me strength when I go to engineering sites and find myself surrounded by scoffing men. My theory is: give respect in order to receive it. And, of course: forgive.

A father's plea and learning to build

During the four months before my Sudanese final secondary school exam, my father started a new business that would refurbish old houses.

He was struggling to find good civil engineers. One day he said, “Widad, you would be very helpful to me by becoming a civil engineer.”

This encouraged me and gave me a sense of responsibility and respect. I decided to study engineering for a cause that was very dear to my heart. It was a proud moment for me and became one of the best decisions I ever made.

I was thrilled when I was accepted in 1977 to study civil engineering at the University of Khartoum, the top ranked university in Sudan. There were only seven women out of about 500 men in the College of Engineering. At that time, the culture and structure in the faculty did not support women in engineering. But we made it!

From a farming childhood to engineering

In my university entrance interview, the professor tried to divert me from studying civil engineering and told me that field work was not suitable for women. My father’s words about how to respond to such comments instantly echoed in my mind, and so I calmly responded by saying, “Since childhood, I was used to riding my donkey. In the summers, watering plants started at 04:00 in the morning, and I spent my cold winter nights near the chicks in their coops, making a fire and constantly checking the the room temperature. This required a great deal of dedication and self-discipline. A delicate temperature balance was necessary, otherwise the chicks would simply die.” I continued, “Professor, is civil engineering much more difficult than that?”

Without further hesitation I was accepted into the course.

The burden of bigotry

There were moments at university when I felt badly discriminated against because I was a woman. One example is the day my design professor called on me to solve an extremely difficult equation on the board. I later realised the equation was almost impossible to solve, let alone when put on the spot in front of the entire engineering cohort.

After standing by the board for a few minutes, I was not able to solve it, just as he had anticipated. The professor smirked and took this moment to express all his prejudices and bigotry by addressing the entire lecture hall. He said that he was never convinced that females should be allowed to study engineering, let alone at the top university in Sudan which is publicly funded. He said that ultimately a seat for a female engineer was at the expense of taxpayers' money.

He continued to say that engineering was made for men only and that women should not pursue it, as they were simply bound to be useless at it. He went on about how women would ultimately become pregnant and never work in their field and be a waste of a seat that could have gone to a hardworking and more deserving man. He said that he believed that capping the number of seats available to women in engineering at 3% was more than sufficient.

I happened to be pregnant at the time and was extremely taken back by his sheer bias, but once again remembered my father's words and my mother's advice on looking forward and working hard. I remember when I sat the final exam for his course, I did not write my name on the exam

paper – only my student number. I was afraid his prejudice would make him fail me.

Change perceptions by leading by example

The irony of the story with my design professor was that about 20 years later, we met again at a project we were both involved in. He informed me that he had been completely against his eldest daughter pursuing engineering. To my surprise he said that, by following my success story through the years and seeing the possibilities for a woman to excel in the field, he fully supported his youngest daughter's decision to go into engineering because he thought she might become the next Widad Yagoub.

This just goes to show how we women can change age-old perceptions when we lead by positive example.

Choose a life partner who is not threatened by your success

I met my husband, Gamal Eldin Osman, in my second year of university. Gamal was completing his master's degree at the Sorbonne University in Paris. We got married in 1980 and had two children together while I was still studying – Zainab and Tasneem. Although many of my professors were critical of me being pregnant and a mother while doing a demanding course, this only motivated me to work harder and excel and I successfully graduated from the University of Khartoum in 1983 with a degree in civil engineering.

I knew that in Gamal I had found the right person; someone who would support me every step of the way. I wanted to have a family but I also wanted to succeed and focus on my career. Instead of feeling conflicted, I

saw it as a challenge, and I was adamant to find the best ways that would allow me to succeed in both. I wanted to be an exceptional mother, wife, engineer and changemaker. And it all came true.

Constructing the dream: the BEE group

When I returned to Sudan after time spent studying in the USA, I started helping my father in his property development business. I was also accepted as a government junior engineer. While monitoring the construction work, I continuously noticed errors and the supervisor agreed with me. The fieldwork and the errors I kept noticing made me realise that most of the contractors were not civil engineers, so I started thinking about establishing my own construction company.

I started BEE Construction in 1985. In order to do that, I needed to buy my own equipment, such as a concrete mixer. I took a murabaha (an Islamic loan) from the bank to buy a concrete mixer and to exchange my car for a pickup truck. My company was the first one run by a Sudanese woman that specialised in building and selling apartments. As the pioneer in building complexes and selling apartments, my company soon built a good reputation.

In 1991, I ventured into gas and oil and formed BEE Petroleum, which currently owns more than 60 gas stations, depots and airplane filling facilities throughout Sudan and South Sudan. Unfortunately, however, we lost a lot of equipment after South Sudan's secession from Sudan.

The secession was a moment of despair to many. Despite the political tensions, the people of North and South Sudan lived and worked together

and there were many family and social ties. My loss was trivial compared to the grief people went through during that time.

In 1998, BEE Construction was awarded the contract to excavate 10km of pipeline extending from South Sudan to the Red Sea. I saw this as a big opportunity to prove our abilities and we accepted the task of building this challenging rocky portion of a pipeline.

Advice to working mothers

In my industry, family time is often limited. My heartfelt advice to women is to focus on quality time, full of joy and appreciation. I always ensured that we spent time as a family while having tea in the morning and evening. I used that time to share my daily programme with my children and listened to everything that happened during their day.

One day one of my brothers came home and asked my youngest daughter, Huda (who was only four years old at the time) if I was always late. She answered, “Mom is searching for a high-tensile steel that is not available these days.” This was heart-warming because it meant that my children were always well-informed about what kept me at work late, and the challenges I faced.

A bank that helps where it's needed

In 2006 I founded the Sudanese Family Bank, the first microfinance-based bank in my country. I provided the \$400 000 startup capital and then worked with other Sudanese businesswomen to source additional capital to run the bank. The facility was established to assist women-run enterprises play their role in our country's economic growth. The bank

provides microfinancing for startups, productive families, women and youth. It became a great success in less than a year, I am delighted to say.

Since its inception, the bank has expanded throughout Sudan, with more than 40 branches that offer services that target underserved segments in our society. The bank's main objective is to alleviate poverty and provide employment opportunities to youth and women through microloans. Its business model has been replicated elsewhere on the African continent and it is a project of which I am extremely proud.

Helping the children of war

Working in many corners of Sudan and other countries in Africa, I visited several refugee camps and villages and cities affected by war. I experienced the negative impact of war on children first-hand, and this strengthened my ideal to see peace everywhere.

Many children were displaced by civil wars and roamed the streets without access to resources. These children were outside the educational system and were not willing to go back to school in its traditional sense because it was a concept that was foreign to them and seemed like a far-fetched reality. Vocational training was the most suitable route for them, so in 1999 I established the Child Development Foundation (CDF) in Sudan.

The following year, I travelled to South Sudan and built a basketball court in a public park near the airport. I did this because I wanted to protect their childhood and restore some joy to their life.

Lessons from my own journey

1. Always initiate things that really matter to you.
2. Trust your instincts; they are usually right.
3. Where there is (calculated) risk, there is reward!
4. Always be professional.
5. Keep your word to earn other people's respect.
6. Don't be afraid of being a pioneer.
7. If you only work in your comfort zone you will never grow, so push your limits.
8. Think and dream big.
9. Consider (and treat) your employees as your most important and valuable assets.
10. Be flexible to change. Adapt!
11. Be positive and optimistic.
12. Don't cry over spilt milk.
13. Happiness is a choice.
14. For women, it's all about balance.
15. Forgive, forgive, forgive.

We must all work together

The race towards gender equality is a human responsibility and can only be achieved when men and women work together. I believe my success would not have been possible if I did not have such amazing women and men supporting me every step of the way. I hope to pave this way a little bit further, inshallah.

JOURNEY 10

FORTUNE FAVOURS THE BRAVE

Cecile Uwimana

*Fellow of the Institution
of Engineers Rwanda*

RWANDA

The power within

My story proves that with enough faith, tenacity and hard work, anything is possible. A career in engineering has granted me the joys of creativity, success and a well-balanced family life. If anyone doubts this, I am here to say that if I can do it, you can too.

My story is one of challenges: surviving the Rwandan genocide, the still relevant issue of entering a traditionally male-dominated profession and a whole string of social prejudices. I kept pushing, and fortune has been good to me.

Keep moving forward

I believe in moving society and people forward. I believe that women,

especially, have more power than they often give themselves credit for. Circumstances can be oppressive, but we must harness our potential. If I were not an engineer, I would have chosen to be a social worker. I love helping people and improving their circumstances.

My engineering journey has been tough, but exciting. I climbed mountains in a field that is to a large extent still considered a male domain. I had the inherent tools of commitment, consistency, resilience, self-education and self-confidence to help me advance. Along the way, I also had stacks of support from various people.

One of these people was Dr Issa Coulibaly, my structural design professor at university. He noticed my potential and introduced a connection that landed me my first job. He used to tell me, “You are talented, you can do

ABOUT THE AUTHOR



Cecile Uwimana holds BSc and MSc degrees in civil engineering and is a fellow of the Institution of Engineers Rwanda (IER). Since 2017, through the GCRF Africa Catalyst Programme, she has supported young graduate engineers in bridging the gap between higher-learning institutions and engineering industries by providing mentorship and internship programmes which link theory and practice to expand graduate employment. As a female engineer, Cecile is a mentor and role model for different graduate women engineers in Rwanda.

Cecile is a skilled project manager and dedicated team leader who has the capacity to build a relationship with all parties to ensure an efficient working environment. Since 2000, she has been involved in consultancy, supervision and project management for different private projects in Rwanda. She has over 21 years' professional engineering experience in the construction of multistoried and multifunctional buildings and utility infrastructure projects.

it!” He likened me to his firstborn when she was taking her first steps. To him, I was taking the first steps in my chosen field. He used to say, “D’abord ma petite Cecile” (My amazing little Cecile) as a way of supporting me in classrooms dominated by men.

Lessons from the genocide

Three decades ago, I was an invisible girl in the countryside of Rwanda. However, I certainly was not alone. Every day and in every way, I was guided by an invisible force I like to call God. He made his presence known to me by keeping me healthy. As I was a sickly child, this protection was nothing short of miraculous.

I was born in a rural village and stayed there until my 15th birthday. By then I had completed eight years of primary school education and moved to another village in the south to start secondary school. After five years, it was interrupted by one of the worst events in modern history – the 1994 Rwandan genocide. In 1995, I moved to the northern province to complete my secondary school education.

The Rwandan genocide, mostly against ethnic Tutsis, is notorious for its horror and cruelty. What I have learnt from witnessing and surviving this traumatic event in my country’s history is that we have to stay strong on the inside. Cultivating spiritual, emotional and psychological strength helps us to survive extreme hardship and teaches us to learn, adapt and thrive.

We must not allow ourselves to become polluted by false rhetoric. We must always march to the beat of our own drum, no matter what. Trust your heart and trust your gut.

A no-(wo)man's land

In 1996, I enrolled at Rwanda's national university in the capital city, Kigali. I soon discovered that engineering was in many ways an uncharted no-woman's land. In my first year, we were six women in a class of 137 students and in my final year we were only two women in a class of 36. Despite the awkward imbalance, I managed to complete my studies successfully.

I was delighted to have come this far. The conditions in my primary school or even my childhood household did not give me hope for a brighter future. I used to think that the best I could expect was to get married at in my late teens, have 10 to 15 babies and die as a poor housewife.

However, my parents, family and friends gave me different advice that helped me in life and kept me steadfast. They taught me what to do in any situation or in the face of challenges. I learnt the value of respecting my parents and older people, loving God and practising Christianity.

I also learnt the value of humility and honesty, asking permission before leaving one's parents' house, coming home in the early evening, studying hard, doing household chores, taking care of guests, being mindful of my sisters and brothers, sharing everything with them, being aware of bad company, focusing on tasks at hand and maintaining integrity in everything. Dreams and discipline go hand in hand!

A part of me always felt that there was more for me beyond my immediate circumstances, and that my future would be bright. The hook was my passion for education, despite our local conditions. I loved school, and mathematics was my favourite subject. I excelled in it and soon attracted

attention. From this I learnt that focus is the key to changing challenging circumstances.

Open versus hidden discrimination

A particular bus journey also taught me a few lessons. As university students we had a complicated group assignment in the laboratory, followed by a site visit. We worked on it day and night and, needless to say, slept on the bus on the way to the site. It was a long journey, and any request by one of the females to stop the bus for a comfort break was mocked. In an attempt to avoid this, I curbed my urge to use the restroom by not drinking or eating anything for hours.

My passion for learning always got me through. When studying civil engineering, I loved every subject and shortly after I graduated, a private design company (Balkan SARL) appointed me as an assistant structural engineer and later as chief water engineer. Five years later, I moved to another private construction company (Real Contractors) as a site engineer. After that, I became a project engineer and today I am a project manager.

Between 2013 and 2019, I was a council member of the Institution of Engineers in Rwanda. I designed and coordinated a project to bridge the gap between academia and the engineering industry through the GCRF Africa Catalyst Project, funded by the Royal Academy of Engineering. In addition, and as a born entrepreneur, I designed and built my own house and four more for rental. There is a saying that a house built by a woman will leak (Inzu yubatswe n'umugore irava), but I definitely disproved this and went beyond it to pursue my career.

Growing in an engineering career involved dealing with opposition and discrimination from people who only wanted to see me as an incompetent woman. I faced hidden as well as open discrimination – “hidden” in the sense of having to wait 10 years before I could land a post of responsibility and “open” in the sense of working with a male boss who undermined me, frustrated me and left me in tears.

Is patience a virtue?

I wanted to make decisions, but I had to be patient, even though I heard about male colleagues who were promoted after five years. This humiliated me, but I stuck to the truism that, despite what others do, your actions matter and speak louder than words. I also had to rethink what my culture calls women’s work or regards as women’s attire.

I also noticed the extent to which some people question my capabilities, especially when I lead a big project. They keep wondering if I will get it right and keep asking if I am sure of what I am doing. On one occasion, I was leading a project worth about \$40 million when people came to meet with me.

That kind of conversation usually went like this:

Visitors: “We would like to meet the PM (project manager).”

Me: “I am the PM.”

Visitors: “Are you sure?”

On the one hand, this reinforced my sense of inferiority. On the other hand, this type of undermining experience strengthened my resolve and motivated me.

Being a project manager now means that I have to make sure my team and I reach our targets and produce results, efficiently and effectively. I pride myself on clear, to-the-point communication. In my field we can't afford to be vague, as it can lead to compromising losses of money and credibility. But I have found my voice. In meetings with my superiors or other colleagues, I am known as "expressive Cecile". I always give my opinion respectfully and never hold back. I also thrive on constructive criticism. Part of me is still shy and timid, but I work on it every day and already see an improvement.

Proudest achievement

To date, the project I am proudest of is my work as PM on the construction of the Intare Conference Arena in Kigali. I have heard stories of people staring at this magnificent building and asking, "Who built this?"

When they then hear it is a woman who built it, they cannot believe their ears. That entertains me! It shows the world what we women are capable of.

Unsavoury golden handshakes

Another challenge I face in my industry is bribery. As I require all kinds of services, such as materials and subcontracting, I receive calls or have face-to-face dealings with people who offer bribes in order to get a contract. I constantly have to fight this type of corruption.

What I enjoy most about my job, is starting projects from scratch and making them visible and useful to serve people. I believe I can achieve what men can, and more. As a mentor, I am also proud of my fellow future

professional engineers becoming more and more empowered.

We know that good people are always around us. I remember how Louise Olofsson, who used to be the GCRF programme manager at the Royal Academy of Engineering, made me feel unstoppable regardless of barriers on my way to success. The biggest of these was to learn English as an adult.

Work/life balance: attainable or just a pipedream?

In my daily life, work is my priority. I work from 07:00 until about 18:00 and sometimes do night shifts, depending on the urgency of the project. Engineering is hard work and requires a lot of time, and I try to balance everything else that involves my husband and our two children around it.

It's not easy to balance my work with my family life. I wake up around 05:30 every working day and prepare my children for school. I pick them up from school around 13:30 or 16:00, depending on the school schedule. I set aside time for their homework before they go to bed, and finally resume any unfinished work of my own.

When my husband is around, time is precious. Due to the nature of his work, he does not stay with us every day. If I have reports to do, I make sure that completing them comes after spending quality time with him. On Sundays, we all attend church. I don't have a lot of me-time, but this is a gap I am dedicated to filling.

My husband is supportive because he respects work and appreciates my financial contribution to our family's wellbeing. One thing he worries about a lot is that I have little time to eat! When he did not have a full-time job, he regularly surprised me by bringing a meal to my office or even to

our worksite. He sometimes still does this and it delights me and warms my heart.

As a mother, I recognise that I am a role model to my children and do all I can to teach them the value of planning, prioritising, time management, endurance, hard work, passion for work and, above all, love of family.

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JOURNEY 11

THE BEST ANTI-AGEING TECHNIQUE? APPLY YOUR MIND!

Ghada Amer

*Vice-dean at the Faculty of Engineering,
Benha University
EGYPT*

When did your interest in engineering start, Ghada? Have you always wanted to be an engineer?

Oh yes, very much so! Many people thought I was delusional because I was already signing my name as “Dr Ghada Amer” from a young age to practise for my future career, ha! ha! But there was just this feeling inside me. I knew without a doubt that one day I would get my PhD in engineering. Even though everyone laughed at me, my mother always reminded me that one day I would achieve great things. Her love and support helped me get where I am today.

Your mother sounds like an amazing woman. Tell us more about her.

My mother was the first woman in her village to complete secondary

school and the first woman to get a university degree. Even though she had to wake up at 04:00 every morning and travel more than 100km to get to

ABOUT THE AUTHOR



Professor Ghada Amer is The Vice Dean for Postgraduate Studies and Research in the College of Engineering at Benha University, chair of the Center of Strategic Studies for Science and Technology & the Vice President of the Arab Science and Technology Foundation. She holds few more positions within her profession, like the Director of Innovation and Entrepreneurship Center at Benha University, CEO, and the Co-founder of ASTF innovation Lab, the ex-Head of

Electrical Engineering Department at Benha University, and the CEO of the Global Awqaf Research Center.

In January 2014, Ghada was named one of the top 20 influential Muslim woman scientists in the world as well as personality of the year in 2015 by Muslim Science magazine in the UK. She was ranked in first place for the 50 most prominent Arab women leaders in entrepreneurship in 2014 by Sayidaty magazine. In 2016/2017, she was named one of the 500 most influential Muslims in 2016 in the field of science and technology by The Royal Islamic Strategic Studies Centre. In 2016, she was selected as one of the jury members for the Rolex Enterprise Awards for Innovation.

Ghada is an advocate for socio-economic development based on RDI in her country and the region. Since 2009, she has worked as a volunteer with the Arab Science and Technology Foundation and later joined as a volunteer manager for its women's programmes. She was elected as a member of the board of directors in 2011 and became vice-president in 2012.

She has developed and led more than 20 projects and programmes to support scientific development and entrepreneurship. During the past three years, she has helped raise more than \$2 million to support research, innovation and entrepreneurial activities that aim to create jobs and to support the Arab community. She has helped establish 142 start-ups for innovative ideas from the region.

class, she did it because she truly believed in the power of education and its ability to lead her to a better life. She's been an incredible role model.

My mother believed in nurturing the mind as well as the soul, always reminding me that what I looked like on the outside was not nearly as important as inner beauty. She said the beauty of a good soul never fades, and she was right.

These days, I continue to share this message with my students. I tell my female students, "Do you know the greatest anti-ageing secret in the world? Use your mind! Apply your intellect and your gifts to help others. This will keep you young and beautiful forever!"

Can you tell us a little bit about your family and where you were born and raised?

I was born in Bahrain and raised in Kuwait, but I am Egyptian and today I live in Cairo. My father was a mechanical engineer and my mother a maths teacher. I am one of two daughters and was definitely the tomboy in the family growing up. I loved playing football, doing chores around the house and helping my father fix his car.

Chess was also a great passion of mine. At 14, I became the national chess champion of Kuwait, holding the title for four consecutive years. I'm really proud of that.

That is an amazing achievement for a teenager. It reminds one of the popular Netflix series *The Queen's Gambit*, about a female chess prodigy who defies the odds and reaches victory. Do you still play?

Not that much, but it will always be a love of mine, and maybe when I'm older and have more time I will play again. Chess is a game of strategy, and strategy is something you need to develop as a successful engineering leader. So in that sense, I suppose I do still play chess, or apply techniques I learnt from the game.

You were accepted to study engineering at a university in Egypt. Back then, how did people around you react?

My parents were very happy, but I got a lot of criticism from my community because many believed that engineering was a field that was reserved for men. But I wanted to do it for my parents. I wanted to create a legacy that would always keep our family name in the sky, you know? They believed in me and I knew I would make them proud by becoming an engineer.

Tell us about your experience in college. What were the facilities like?

Honestly, it was very challenging. The campus and programme schedule were not at all designed with women in mind. We did not even have a ladies room for the first three years! Classes only finished at 19:00, which meant we had to travel at night in dangerous buses, and men often harassed us on our way home. It was tough.

Were you treated differently by your lecturers or classmates because you were a woman?

My classmates were friendly, but I don't think I really had their respect until I got top marks for our first exam. Once people see what you're capable

of academically, they quickly change their attitude.

As for some of the lecturers, I'm sad to say I had some unpleasant experiences. Many of them didn't like women being educated and would often ignore me in class when I asked questions or tried to participate.

There was even one incident where my academic supervisor tried to sabotage me by giving essential software needed for our course to all the male students but not to me. It was a bitter pill to swallow, and so demotivating. Fortunately, I also had lecturers who treated me equally despite my gender. Professor Osama Goda was the supervisor for my master's and PhD, and remains my great mentor. He really believed in me, supported me and continues to champion me to this day. There are good men who support women in engineering and the wider STEM field completely, and for this, I am grateful. Now we just need more of them!

How did you see yourself after graduation?

I was very proud of myself. I came first in my class and was appointed as a teaching assistant. This was a prestigious position that was only offered to the top performing student. Even though I was a woman, my results spoke for themselves, and this gave me a great drive to continue.

Were you ever encouraged to get married instead of having a job or career?

No, I was never expected to choose between one or the other, but because of my cultural background I was still encouraged to wed. I got married at 21, but it had been difficult to find a suitor because I was a highly educated woman with the intention to work in a male-dominated field, and most

men wanted a woman who would stay at home and take care of the house. Luckily, I found a husband who was not intimidated by my success.

What type of environment was your first place of work?

It was quite challenging, to say the least. Being young, and on top of that a woman, meant that I commanded very little respect from my male peers. It was a very religious environment where men didn't trust women in engineering to do the work properly, which gave us hardly any opportunities to contribute. It was very frustrating.

Did you have to change your personality or behaviour to “survive” in a male-dominated work environment?

I worked twice as hard, continuously furthering my knowledge and skill set. I was determined to be a valuable member of my department because I didn't just want to just survive, I wanted to excel. I think for most women in the field this remains true – we have to put in double the effort of male counterparts just to achieve respect and recognition.

In addition to being an academic, you are a successful entrepreneur. How did this come about?

I've always disliked routine and wanted to explore new opportunities to be the first social entrepreneur of my kind. I joined multiple NGOs and went on to establish many initiatives to spread awareness on innovation and entrepreneurship, particularly in rural areas. I've recently established a startup centre for strategic studies in science and technology because I believe it can assist developing countries participate fully in the fourth industrial revolution (4IR).

Do you ever feel opposition for putting too much time into work?

Not at all. I love my work, so much so that it doesn't even feel like work! Engineering is such a stimulating field, constantly generating new discoveries and innovations. That said, my dedication does mean I'm not always able to attend social events. I do my best to have a good work/life balance, and fortunately my family is very supportive of my work. But yes, I miss the parties!

What values do you bring home as a mother, and as a woman who works in the engineering and wider STEM field?

I think children learn by the example their parents set. I have two sons who have seen all that I have achieved, my work ethic and the passion I bring to everything I do. When my youngest son was in primary school, his teacher found out who I was, telling the whole class my success story. That made him very proud. Both my sons went on to study engineering and always tell me that I am the reason they fell in love with the field. That really makes me feel wonderful, to have been a professional role model for them.

Have you ever felt judged by other women or relatives because of your work?

I was definitely judged by some women – particularly those who didn't work – who felt that STEM wasn't an appropriate field for women. They wanted me to stay home and warned that engineering would mean I'd lose all my femininity. I am proud to have proved them completely wrong. Femininity and engineering success are by no means mutually exclusive, and this needs to be emphasised far more.

We understand that women in engineering, other STEM and

related fields are still considered a little unorthodox in more traditional societies in Africa. What do you think needs to be done to encourage more women to enter these fields?

We need to combat stereotypes about gender and intellect from the first grade in school, not labelling certain subjects as more appropriate for men or women. Girls need to be taught the growth mindset. We need to instill in them that their abilities can be developed and don't need to remain static or unchangeable.

Negative stereotypes rest on the assumption that women lack the innate ability needed for success. We need to frame failure as a learning opportunity instead of something to be avoided or brushed under the carpet. Troubleshooting mistakes and solving them is incredibly empowering.

Lastly, we need to talk about successful women, just as my son's teacher did. Stereotypes can be challenged by exposing girls to examples of women who have succeeded and thrived in the STEM sector. We need to show girls and boys alike that these women are relatable and highlight how they have become scientists, making it easier for girls to envision themselves following the same path to success and allowing boys and men to create space for them to do so.

What unique perspectives do you think women bring to academic or industry jobs?

Women focus on teamwork – all the women I've worked with have consistently demonstrated passion, enthusiasm and an immense capacity to serve and be served by others. We make bold and wise decisions as leaders, while relying on others to be part of our team. The environment

is less authoritarian and more cooperative and family-like, but with solid leadership.

Communication is said to be among women's strongest skills, and female leaders certainly know how to use it. Whether communicating with employers or co-workers, an open communication stream allows for clarity in executing roles and responsibilities.

Women defy the odds and they make great leaders precisely because the odds are against them to lead. When you've been an underdog your whole life, it takes an extra push to get to the top. That's why women who emerge on top are extraordinarily strong and capable – we had to fight extra hard to get there.

What do you think needs to change for the environment to be a little less hostile towards women?

We need to start by recognising the problem. Women aren't leaving their studies or jobs just because they want to start spending time with their children. They are leaving because of the difficult workplace climate and lack of opportunity to advance. Change needs to start from the top – managers need to start a culture that doesn't tolerate incivility or condescension towards women, and respects all employees' work/life obligations.

They need to implement systemic changes, investing in professional training and development, making it clear how people advance with fair criteria. In other words, breaking up the old boys' network.

How do you encourage female colleagues, students or interns?

I work as a volunteer with an NGO, the Arab Science and Technology Foundation, and have established many initiatives to empower women in science and technology. I think by being a role model and mentor, I encourage women in the sector all the time, directly as well as indirectly.

What matters most to you in your profession or workplace?

The most important thing for me in the workplace is equality. My dream is for women to have more job satisfaction, and the opportunity to do meaningful work. We need women not to experience burnout so that they can support themselves as well as their families fully and fairly without working themselves to death.

Tell us what you enjoy most about your job. Tell us about your inspiration and aspiration, your struggles and victories, and your message to all the women who need to hear that they can succeed.

I love training people, not only women but anyone working with new technologies that help improve lives. I want to play a part in a system that can help the greater good and bring peace to our region and the wider world. Science, technology, innovation and entrepreneurship are incredibly valuable tools in creating job opportunities and decent lives for all members of society. I believe that anyone, no matter their gender, should have the opportunity to change lives.

My life hasn't been easy – I grew up in a culture that celebrates male

lineage and I didn't have any brothers. Although my father was a staunch supporter of his daughters, it isn't hard to imagine the social conservatism that came bearing down on him. It was then, recognising the helplessness on my father's face, that I vowed to carry our family's name with honour. My career testifies to this long-kept promise.

Is there any other particular advice you think is important to pass on to people who enter the field?

Make a family! And don't misunderstand me, please. By this, I don't necessarily mean a conventional nuclear family. If you don't want or cannot have kids, it's totally okay. But you need your special people. You can make a family from anyone around you. Good friends, close colleagues, a partner or even a pet. Just don't feel you can do it all alone or on your own. People need people. It is the personal connection that ultimately sustains us.

This is what I found with my husband, Abdalla Alnajjar, who, from the first day he met me, believed in me and explored new directions for how I could use my talent to support all living things. He has worked closely with me to set up many projects, initiatives and activations to use research, development and innovation for sustainable development. We have a wonderful relationship.

Thank you for sharing your amazing journey. It was an honour to connect with you!

Thank you. I spoke earlier about how important it is for young women

to learn about successful female engineers and their path to success to be able to envision that path for themselves. That's what makes publishing this book so valuable. I am proud to have my story included in it and I am hopeful that it will inspire the next generation of young women to become the future faces of engineering.

JOURNEY 12

ONE WOMAN AT A TIME

Debby Blaine

*Associate professor of mechanical
and mechatronics engineering at
Stellenbosch University*
SOUTH AFRICA

When did you first become aware of engineering as a possible career choice?

Growing up with a father who was an engineer, I had a relatively clear picture of what it entailed. He's also a mechanical engineer (as I am), and I grew up watching him work on our cars in the garage and fixing things in his workshop. My father was very hands-on and patient with my endless questions – if I asked how something worked, he would explain it to me, so my curiosity was encouraged by my environment.

Where did your father work? Was he also an academic like you?

He owned and ran a factory that manufactured automotive parts for 25 years. As a young girl, I would work with him at the factory during my

midyear school holidays. I loved the factory, seeing how things worked seamlessly to produce a consistent quality of product; something that would go into a car that I might drive in. I don't think I chose engineering due to my closeness with my father, but I was exposed to it through him and it resonated with me.

When did you first realise you wanted to study engineering?

Growing up, I wasn't sure what I wanted to study. I had considered

ABOUT THE AUTHOR



Deborah (Debby) Blaine is an associate professor of mechanical and mechatronics engineering at Stellenbosch University in South Africa. She teaches undergraduate engineering classes in strength of materials and materials science and supervises both undergraduate and postgraduate research students. Her disciplinary research area is powder metallurgy (PM), including sintered materials and additive manufacturing and the mechanical behaviour of materials. Debby is passionate about engineering education and has been awarded a teaching fellowship at Stellenbosch University for 2021 and 2022. She is currently researching the collaborative design of learning opportunities in engineering, seeking out the student voice in order to promote diversity and inclusion.

Prior to joining Stellenbosch University, Debby was the deputy manager of materials research and development at Bleistahl Produktions GmbH & Co. KG in Germany and a PM valve seat insert and valve guide manufacturer.

She holds a PhD in engineering science from Pennsylvania State University in the USA and a BEng in mechanical engineering from Stellenbosch University. She is a fellow of the South African Institution of Mechanical Engineering (SAIMechE) and served as its national president from 2018 to 2020. She is a founding board member of the South African Society for Engineering Education and was its national president from 2017 to 2019.

law, but I really enjoyed maths and wanted to do something with that. The turning point came in Grade 11, when I went to an engineering winter school at Stellenbosch University. The Engineering Faculty organises it every year so that high school students can experience what the engineering field is all about.

I was fascinated by the things we did and loved exploring how maths and science could be applied to create something useful. Being useful and creating something that could help society really appealed to me, and I had loads of fun, so the camp kind of solidified my choice.

Did you ever doubt your choice, or were you always quite sure, and how was your undergraduate experience?

American TV shows like *LA Law* and *Ally McBeal* made me consider a legal career. The investigative, murder mystery side of law really appealed to me, but of course that isn't really what law is about. Or it's only a small part of it. When I attended the winter school, it became clear that engineering was a better choice for me, and as soon as I started studying, I knew I had made the right decision.

The subjects were interesting, I understood what was going on and I did well in class. It provided self-validation knowing it was something I could do, and do well. In my first year, there were only five women in my class of around 110 students. In the end, I was the only woman from that first-year class who obtained a mechanical engineering degree.

Did you feel isolated because of being one of so few?

It was a combination. I think part of me felt proud that I could hack

it and that I was accepted by most of the men in my class as “one of the guys”. At the same time, I didn’t have the same support system. There were one or two women in my university residence who studied engineering, but none of them did mechanical engineering. So, unlike most of the guys in my class, I didn’t have anyone to ask for help or notes if I missed class.

This was before the internet or cell phones made it easy to communicate over text or email. The only way I could ask any of my classmates for help was by physically going to their residence and asking to speak to them in the hallway.

In my second year, I went to an all-male residence where many of the engineering students in my class stayed to ask a classmate for help on an assignment I was struggling with. Waiting in the hallway for him to come downstairs, I felt the eyes of many guys walking past staring at me. All of a sudden, I was self-conscious and felt like they were thinking, “What is she doing here? Who is she visiting and why?” For the first time, I became aware of the social aspect of being a woman in the class; that I was different and not everyone saw me as one of the guys. My carefully curated persona that protected me was showing cracks.

I think it’s important to note that this kind of prejudice does not have to be explicit – it may just be in the head of the minority person, but it is still real. That is why I use the term “microaggression” to refer to it. It isn’t explicit, but it is perceived, and that makes it almost more difficult to deal with as you sit wondering whether you are being “a silly girl” or whether what you observe is real and accurate.

Did you go straight from your undergraduate to your postgraduate studies?

I started my master's directly after my undergraduate degree, but then I got an opportunity to do my PhD in the USA, in the field that I was really interested in. I was awarded a full scholarship to study for my doctorate under Prof Rand German, one of the global experts in the field I was most interested in – powder metallurgy (PM). This was very exciting! I went to Pennsylvania State University and started my PhD on the scholarship, with the idea that I would write up my master's while I was there, but I never got to it.

So you skipped your master's and just got your PhD?

Yes. I completed my PhD in about 3½ years and then stayed on for a year as a research associate at Penn State University, where I was based. At the end of my studies in the USA, I was awarded the Penn State Alumni Association Dissertation Award for an outstanding doctoral dissertation.

Thinking back to your experience of the USA, was there any kind of culture shock for you?

It was quite interesting – because I speak English, come from a middle class educated family and have white skin, I seemed to fit into the American culture rather seamlessly. My first year was really just about settling in, getting to know people, making friends and getting used to the new academic environment. Everything was exciting and new, so it was easy; but in my second and third year I got really homesick. I missed my family and friends, and although I had made some good friends, things were just not the same. People misunderstood me, misinterpreted my actions and

questioned things that I take for granted. I didn't have people to talk to who understood where I came from, who I was. It was incredibly draining.

Do you think that was because of the cultural differences between you and your upbringing in South Africa, as opposed to the way things were done in the USA?

Absolutely. I expected the USA that you see in the movies, but the reality is that New York and Los Angeles are two distinct cultures and do not represent the whole country. A large portion of the USA is made up of small towns and farming communities. Their outlook on life is quite conservative – at least it seemed that way to me, who grew up relatively close to a cosmopolitan city like Cape Town.

Another aspect of American culture that I found difficult to understand was the direct link between hard work and success – the American Dream. There's this outlook that you can achieve anything if you work hard enough. And if you haven't achieved success, it's because you haven't worked hard enough – you have no one to blame but yourself. Particularly for American citizens, regardless of their different cultural or socioeconomic background, there is a perspective that everyone is free and has the same opportunities. Of course, this was 20 years ago when I was in the USA, so I think this perspective has changed somewhat over the last decades, especially with the Black Lives Matter movement.

When I went to the USA in the early 2000s, coming from South Africa, I went into this environment acutely aware of disparities and of my privilege, and I was sensitive to that. It surprised me that there wasn't a sensitivity

to that among the majority of white Americans I encountered.

There seemed to be little cognisance of the correlation between day-to-day racist behaviour and what I had observed growing up in apartheid South Africa. People would ask me what it was like to be in apartheid South Africa, and I'd think, "well, a lot like here, actually!". So many of those inequalities were present there too. I think it has to do with the fact that prejudice doesn't have to be explicit to be real. Marginalising or just not "seeing" others or making space for them can be incredibly painful and challenging to deal with. This gap stresses the importance of honouring and respecting different cultures.

Was apartheid talked about in your household? Were you aware of these differences and that there were racial categorisations on a legislative and systemic level?

I didn't have any kind of activist sensibility at that stage – at the most I thought it was weird. I remember wondering why my (non-white) friends couldn't go to the beach with me. I attended a multiracial convent school, so I was used to an inclusive way of doing things. We didn't really talk about it at home; it wasn't spoken about as a human rights violation or as something that had to be dismantled. My parents did instil in us to treat everybody equally and with respect, so I was still raised in a liberal manner even though apartheid itself wasn't explicitly discussed.

What happened in your career path after your time in the USA?

My father was at the point of retirement and he started proceedings to merge his automotive manufacturing company with a leading PM

manufacturer in Germany, Bleistahl Produktions GmbH & Co KG. They wanted to bring me on board to train in Germany and then run the South African operations. The company was family-owned, so there was good synergy between the two environments, and I had the knowledge and skills. I moved to Germany in 2005 and trained there for six months. Then the German company decided to pull out of the merger, so I had to make a decision about my future.

Were you out of a job because the merger didn't go through?

No. By that time, I had made good friends with my German colleagues and we worked well together. Bleistahl said that even though they were no longer going ahead with the merger, they still wanted to have me on their team. They offered me the position of deputy manager of the materials and research development team. I stayed on for a year, finishing off a development project. But ultimately, I missed home. After serious contemplation about what I wanted to do with my life, I decided that the place where I could make the biggest difference was through tertiary education in South Africa, and I applied for a position at Stellenbosch University. My decision to return home and move over to academia was challenging, for example taking a 60% pay cut.

A big part of that decision was related to how disconnected I felt to many of the first world attitudes. Both in Germany and the USA, success in life is related to an individualistic pursuit of financial success and status. But I grew up in South Africa, where the disparity between “haves” “have-nots” is impossible to ignore. The lack of community and care that people in the

first world have for their fellow humans was difficult to digest. The idea of only being here to look after myself and my people just wasn't for me.

As someone who's lived on three continents, do you think your attitude is something that is innately African? What do you ascribe that feeling to? Or do you think it's an individual feeling?

In South Africa, you can't pretend that there are not people who are struggling to survive on a day-to-day basis. You can't switch off the TV and then they disappear. They're around every day. They are people you interact with. They are real people who have lives, who have families, who work hard and struggle. And that whole first world mentality of "you get what you deserve" just blows up in Africa. It makes no sense. I felt a way in which I could make a tangible difference was if I came back to South Africa and trained engineers at one of the top engineering universities.

I left South Africa in 2000; it was six years into our new democracy and my dream of our rainbow nation was still fresh. I wanted to be part of this project, to make a difference and give back some of the experience and opportunity life had afforded me. If I could be one lecturer in that space who drove equity, I could make a tangible difference in Africa, in South Africa, in my community. So, in 2007, I joined the Mechanical Engineering Department at my alma mater, Stellenbosch University.

How did you navigate the complexities of that social dynamic while teaching hundreds of undergraduate students?

I don't think I really thought about the social dynamic at first. In my naive initial view, I thought the way I was going to make an impact was educationally, by training engineers. But it wasn't that simple.

I quickly saw that although there was transformation in the demographics of the students, it brought a level of complexity into the classroom that was not being addressed and that had a significant influence on student learning.

I became quite vocal about this in my faculty. I think what I have succeeded in is being a voice that exposes the complexities in our classroom. As engineers, we can't ignore the social complexity of the society we live and work in. It's there, it's real and it influences the way in which students learn and what their university experience is.

So, I've been able to say in faculty meetings, "Don't tell me that everybody has the same opportunity to finish the assignment on time." I mean, I know first-hand. As a first-year student, not knowing anybody. I had no one to speak to.

In our classes there are students who live far from campus and have to depend on unreliable public transport. And there's nobody who can answer their questions. They are simply not in the same situation as a privileged student in a residence who can engage with fellow students, with their residence close to class and internet access at all times.

Were you heard by your colleagues? And was there some flexibility

implemented around these issues?

It's been a transformational process, and it's ongoing at Stellenbosch University

And you've been part of that transformational process by being invited to speak up for people who might have needed someone to represent them.

Yes. After being the squeaky wheel for a while, I started to be invited to represent the Engineering Faculty in different multidisciplinary, educational spaces. Previously, the faculty was known for saying that a lot of the debates on campus were not really relevant to our context. They felt that they weren't social scientists, that they're not in the humanities, and that these kinds of curriculum interventions could not be incorporated into the engineering programme.

I've been able to go into those spaces, listen to what is being said, and imagine how we could incorporate change into our spaces.

Traditionally, there's been little non-technical content in our curriculum. There's never a class discussion or debate based on opinions. It's only $x + y = z$. But what has happened in engineering over the last 20 or 30 years, especially with the globalisation of work, is that people realised they can't not engage, interact and communicate with their team. They need to be able to translate their technical expertise in a way that is understood by others. I've become really interested in that aspect, and I've realised how

important the so-called soft skills are.

Would you say you try to equip your students with those soft skills in tandem with the technical skills that you're training?

Absolutely. When I started in academia, my focus was on academic research in engineering, and on transferring engineering skills to young engineers. What has happened in my personal transformation over that time, is that I realised that the systemic environment makes a huge difference and that learning is not solely a cognitive action. It depends on your entire environment, how you feel in that environment, if you feel you belong, and so on.

What was it like for you when you were a student? How did you feel being the only woman in a class of 100 men?

As a student, I wasn't aware of how you assume an identity that is not your own in order to fit in. I had this pride in being "one of the guys", but it was only later in life when I was speaking to women engineers when I suddenly realised, why the heck did I have to pretend not to be a woman, just to feel safe? So I stopped doing that and embraced being female.

Do you think that's changing? Or do you think that's still very much the case for women in engineering in Africa?

I think it's changing. I've learnt that transformation happens through critical mass. The dominant culture is not going to change out of an altruistic feeling that there should be equity, because there's nothing in it for them.

How do you create critical mass for women in engineering?

By reaching and empowering one woman at a time, and through active mentorship. “Hegemony” and “dominant culture” are words that I’ve learnt in the last 10 years, from being exposed to the humanities and social sciences. I now feel a sense of duty and agency in being a role model; to highlight why it’s difficult for others to operate in an environment that is dominated by a specific group, for example engineering as a male-dominated sector, which of course it still is.

Tell us about some of your career highlights in academia.

In 2017, I was promoted to associate professor in mechanical and mechatronic engineering – the first woman to be appointed to this level since the department was founded 75 years ago. I was also elected as the first female national president of the South African Institution of Mechanical Engineers (SAIMEchE) in 2018. I am a founding member of the South African Society for Engineering Education (SASEE) and was national president from 2017 to 2019. I received the Stellenbosch University Teaching Award in the Distinguished Teacher category for the Faculty of Engineering in 2018.

What have been some of your greatest challenges, and have you overcome them?

The biggest challenge of my career is being a working mom. I don’t think it’s something you overcome; it is something you engage with every day!

Trying to find the balance between being there for my young son in different ways as he grows up, and keeping up with my work while making sure I don't burn out is really challenging. After that, I think the stress I felt when I started working at Stellenbosch University, trying to establish myself as a researcher without having a local mentor in my field of expertise, was extremely high.

I had to reach out to people I didn't know, create my own networks and establish new relationships from scratch. Again, I don't think it's something I overcame; it just got easier once my hard work started paying off. I was diagnosed with breast cancer in 2009, just two years after starting at Stellenbosch University, and that taught me the dangers of pushing myself too hard and carrying too much stress.

Realising that my world doesn't come crashing down around me if I don't work for several weeks was a big wake-up call. And realising that there were so many kind and generous people at work who were supportive and invested in seeing me succeed was very encouraging.

How do you navigate working while raising a child?

I have always felt a duty to be open about the struggles I experience as a working mother. I remember the day I had to make a plan when my son got sick at school. I decided to take him with me to class to rest, while I continued to teach. I could have cancelled my class or tried to make another plan but then I thought, no, this is what I'm dealing with. And the students

should know that as a professional and a parent, this is the kind of stuff you sometimes have to deal with. Last year, I had a female student who had finished her degree come back to me and say, “You gave me hope, because you did not hide that aspect of your life. I now know it’s possible to be a woman, to be a mom, and to be an engineer who acts professionally.” So, yes, my action resonated with her. And that’s my “one woman at a time”.

Any final thoughts you’d like to leave with us?

I’ve been thinking a lot about what it means to be an engineer. We do not baulk at problems – we embrace them. A problem is an opportunity to apply your mind and find a solution – not just one solution, but several.

And then we can dig deeper, tackle it from different sides and find out which one is best for a particular situation, because as soon as one of the variables changes, the context changes. Then we have to go back a few steps, recalculate and find the next best solution. And so, your whole life rolls out ahead of you – moving from one challenge to the next, finding the joy in that beautiful solution and the benefit it brings to those around you, feeling the inspiration to find more people who could benefit from the solution, finding new problems that can be solved.

JOURNEY 13

WOMAN UNLEASHED

Nozipho Dlamini

Technical services manager,

Thungela Resources

SOUTH AFRICA

Nozipho, let's start with what you currently do in your career.

I lead a team of technical experts that support a coal mine in South Africa's Mpumalanga province. My team consists of mining engineers who do the long-, medium- and short-term planning and scheduling for the mine. The geologists do the exploration and grade control to ensure that we mine the best quality minerals. The rock engineers ensure the safety and stability of the underground workings through statistical designs and support standards. I also lead a team of environmentalists, surveyors and business improvement specialists.

That's no small portfolio! You are also a mother of four young children. How do you manage it all?

With a lot of help and coffee! I have full-time help around the house

and a hands-on husband (who is also an engineer, so he gets it). Without the extra help I wouldn't be able to balance it all. I am also a serial planner

ABOUT THE AUTHOR



Nozipho Dlamini was born in 1986. She holds a BEng in mining engineering, a BEng (Honours) in technology management and a master's in technology management. She is a highly skilled mining engineer with more than 13 years' experience in the sector. Her strong leadership skills and good business acumen have allowed her to assume several roles on her career journey, where she has made a measurable impact.

She is currently the technical services manager at Thungela Resources, a prominent producer and exporter of thermal coal in South Africa, and leads a diverse and inspired team of professionals which includes mining engineers, geologists, surveyors, rock engineers, environmentalists and business improvement change agents. The group continues to set new benchmarks in challenging conditions through applying innovative solutions and maintaining a high-performance culture.

Nozipho has a strong academic background and is technically adept. As a trained Lean Six Sigma Blackbelt, she has a passion for improving business performance and processes and was received the Sasol Mining Inyanda Award in 2012 for best Lean Six Sigma improvement project. She has lectured a quality management course at the University of Pretoria's Graduate School of Technology Management, where she continues to supervise and examine master's research theses each year.

Through her numerous accomplishments, Nozipho continues to have a growing impact on the coal mining sector, challenging the status quo in a male-dominated industry. She currently serves as the vice-president of the South African Colliery Managers Association (SACMA), a professional body for managers across the coal industry. She is the first woman to hold this role in the organisation's 40-year history. She serves on several advisory boards in academia and industry.

and schedule specific pockets of time in my day for work and personal time with my husband and children.

The truth is that to make it in this industry, you need to put in the work, sweat and hours. It's the only way to build up the knowledge base you need, and the experience and skills required to lead others well. You have to be motivated, disciplined and dedicated. I suppose it takes a measure of ambition and a lot of self-belief too! My husband and I have also matured and grown stronger, both as a couple and as a domestic team trying to keep it all together, especially during the pandemic lockdowns. It helps being a good, cohesive team on the domestic and personal front.

What would you say is important to balance a demanding, successful career and maintain a healthy marriage?

I don't think there's a "one size fits all solution" to balancing family life and professional commitments. In terms of marriage, I would say that you need to recognise that conflict and arguments aren't about breaking each other down, but should rather be about building the foundations of a stronger, better functioning relationship. When we view our conflicts from that perspective, it helps us grow stronger together. We have each other's back and that's very fortunate, especially because we're both in high-pressure roles.

You have quite a following on Instagram, using the handle @nozipho_unleashed, with almost 2 000 followers, where you describe yourself as "Parenting|Career|Bad-assing Mom of 4. Juggling it all imperfectly while having FUN!" Tell us about this

narrative and what it means to you?

For me, my presence on social media is about setting an example for future generations. I want to show young girls and women that we can have it all and that women can now take up space in traditionally male-dominated fields, while men need to feel empowered to do things regarded (incorrectly) as being in the female camp. I get a lot of messages from moms trying to build successful careers and balancing family demands. I coach and mentor them through my platform.

I share simple hacks for productivity on my profile, like meal prepping in advance, how to get quality time with your family and the exciting (and educational) activities we get up to. Productivity is a big driver to building a successful career in engineering. I show how you can do simple things to be able to balance a career and a family. I also share mom humour, because the journey of being a working mom is hard and we need to normalise the imperfections and find humour in it. I also feature and get featured on pages of moms in demanding careers to share their professional journeys and tips and tricks to juggle it all.

I also share my parenting journey and how my husband and I support each other through different roles and the demands of those roles. When my job becomes demanding, he holds down the fort, like I did when he was busy with his PhD. So it's about give and take.

The businesswoman and author Sheryl Sandberg said the best career decision a woman can make is who she marries. We are a good example, as we push each other and support each other.

Where were you born and raised?

I was born in a small town called Bethal in Mpumalanga. At the age of four, I moved to Soweto in Gauteng province to live with my paternal grandmother, as my parents were no longer together. Soweto is a vibrant part of Johannesburg, with a diverse melting pot of cultures. We had access to important resources and facilities, and were close to great universities. My upbringing in Soweto meant that I was able to learn (and now speak) nine of South Africa's 11 official languages. This really came in handy when I started working at the mines, as the employees came from all over the country.

What kind of games did you play as a little girl?

I played whatever the neighbourhood kids played. We played with marbles and spinning tops, and we played street soccer and various other seasonal street games. As I got older, I preferred spending my afternoons reading at the library or borrowing books and reading at home.

What profession did your parents have? Were they supportive of your higher education?

My father worked odd jobs all over the country and wasn't home much. My grandmother was a homemaker and unemployed most of her life. She was very supportive of my higher education, but wanted me to study something that would guarantee future employment and a prosperous future. I had initially shown interest in studying literature, because I was passionate about reading and writing, with hopes to one day write great African novels. Unfortunately, when I told my grandmother my intentions, she was not

impressed! At that stage, African literature wasn't that popular, and there weren't any successful writers that looked like me. If I didn't become an engineer, I think I would have loved to be a children's book author.

Did your parents or grandmother differentiate between you and your siblings as you were growing up?

I'm the only child and only grandchild in my family, so I suppose I was fortunate in that there was no opportunity to compare me to another sibling. I was lucky, because my granny gave me the opportunity to try out new things without too much resistance. She was quite progressive and let me make my own decisions, always reiterating that my life is my own and that the choices I make are my responsibility to deal with, good or bad.

When did you decide you wanted to study engineering?

It was in high school. I remember I had a cousin who had studied geology and got a good bursary from a big mining company. They covered all her expenses, bought her a laptop and gave her pocket money. Above all, I saw the financial relief it gave her parents and how proudly they would speak of her. I did well in maths and science in school and wanted to get a bursary that would offer this kind of relief for my family. A lot of engineering companies offered bursaries, and I started researching the fields I might be interested in. I realised I wouldn't get a bursary to study literature, but I figured that I could still write books as an engineer.

How did people react when you announced that you intended to study engineering? Did anyone advise you to pursue a more "goal-appropriate" career?

My family was thrilled and just relieved I wasn't going to study literature! I was never advised not to study engineering because of its male-dominated image. South Africa was an emerging economy and the mining industry was starting to embrace diversity and female recruitment. There were many opportunities in the field for someone like me and since I had a successful cousin who was a geologist at the mines, my family knew I would have a lot of opportunities to thrive.

When you went to university, did your classmates or lecturers treat you differently because you are a woman?

Not at all. I was also lucky that I managed to develop a close relationship with the other women in my class. We supported one another, ensuring that we all stayed in the same hostel so that we could study together. All of us got our degrees and remain good friends to this day.

Was your campus woman-friendly?

It was, yes. We had good student accommodation that was close to the university, and there were security guards to walk us back to the residence after a night's studying on campus. Reliable bus services were available that could take us to other campuses and residences.

Do you think things have changed for the better for the present generation of engineers?

I think they have, yes. Although my department (being mining) had only an 80/20 male to female ratio, the Engineering Faculty as a whole was more balanced, and female numbers studying engineering have increased over the years. Mining was seen as a tough and aggressive area, so that's

why we had fewer women in that course.

Did you have any field experience or do an internship while you were at university?

The company that offered me my bursary gave us an opportunity to visit their operations in my final year. They wanted to expose us to the working environment so that we'd know what we were getting ourselves into. Besides that, I did a paid 2-month internship over my Christmas holidays throughout my university years. It gave me an opportunity to experience the work I'd be doing, engage with already practising engineers and start building my confidence to engage with senior leadership. I remember winning the best student project two years in a row, ensuring that leadership took notice of me and making it easier to find work after completing my studies.

Did anyone ever advise or expect you to choose marriage and a family over having a career?

No, quite the contrary. My family always pushed me to do well at school and go on to study and have a successful career. My grandmother was so supportive that she gave me fewer chores than my peers so that I would have more time to study.

Did you have any special people, like a mentor, who encouraged you on your journey?

I was lucky enough to have had quite a few over the course of my life. My Grade 3 teacher used to call me Maqinasi, which means “the smart and curious one”. Her faith in me really pushed me to do better. Later on,

my first female boss, Asanda Ludidi, was also incredible. She was a kind, spiritual and authentic person, allowing herself to be vulnerable and yet strong and goal-driven. She taught me that if you treat people with respect and lead with your heart, they'll feel genuine care for your wellbeing and stand by you. I saw how much her team respected her and believed in her leadership, but she earned it without having to be rude, unkind or arrogant.

Was there any difference in the amount of dowry that had to be paid when you got married?

In African cultures the man's family traditionally pays dowry to the woman's family based on her level of education. I always joked that my family definitely undervalued my worth and settled for a lower amount! In reality, a woman's worth is not really determined by the dowry, and the intent is not to buy a wife, but to unite the families. At least, that's the reason my grandmother gave for undercharging my husband's family. Ha! Ha!

How did being a female engineer change your social status?

Quite significantly. Families want to show you off to their friends as the educated engineer and you have a lot of people who approach you to guide their kids in career choices and even jobs.

What are the kinds of challenges facing women in a hardcore, engineering-orientated industry that may differ from the experiences of their male counterparts?

In my first job I had a male colleague who was equally smart and

passionate about his job. While he was seen as hard-working and results-orientated and someone who didn't take nonsense, my passion was seen as rude, arrogant and know-it-all. It made me feel that I had to filter and downplay myself so that I didn't appear threatening. Another challenge I faced was being overlooked for certain opportunities, because as a mother I would be seen as being too focused on my kids rather than on my career. Men who are parents are never seen as potentially unable to perform well at work.

Was it difficult to find a suitor because of your qualifications or career choice?

No. My husband was also an engineering student and has always supported me in my career. He pushes me to take opportunities and has unbelievable confidence in me. He has never been threatened by my success, so it makes pursuing my highest goals easy.

What values do you bring into your house, being a working woman and operating in the engineering and wider STEM field?

I have twin girls and I want to show them that the sky's the limit! As a feminist, I would like to believe I am raising my sons to be feminists and to never believe a woman to be inferior in any way. My husband and I also don't conform to traditional gender roles, so I trust that my children will not subscribe to those antiquated beliefs.

What unique perspectives do you think women bring to STEM-

related jobs?

Talent attraction and retention. I believe my progression in my career has encouraged other women to be bold and strive for more technical roles. Women also have important softer skills, like empathy and communication. This allows male colleagues to talk about their personal lives and families, which helps build stronger personal relationships and in turn better professional ones too.

We understand that in traditional African societies, women in STEM-related fields are sometimes still seen as a little unorthodox. What do you see as your role and responsibility to encourage women in this area?

My role is to inspire, coach and mentor. I need to advocate for female development where I work, and support women and their career aspirations in STEM. I also need to model the notion that women can be both great engineers and balance a family life. There are still far too many people who believe that women are not able to do both, and that needs to change. Women need to know that they don't need to give up one for the other, and employers need to change their antiquated beliefs that women won't work as hard when they have children at home.

What do you think needs to change for the environment to be less hostile towards women?

Mining still has a long way to go in accommodating women properly.

The work schedules and lack of automation are still big barriers and result in women avoiding this field. Accommodations that have been made for women have actually helped men too. When we set up a Women in Mining forum, it inspired the men to do the same. The men's forum has given them the opportunity to talk among themselves about important issues like mental and physical health. We get doctors, peer educators and therapists to engage with the men. These sessions have been hugely beneficial to them, but never would have happened if the women's forum hadn't inspired them to do it.

Do you think female engineers face more challenges in Africa than abroad?

A lot of developed countries are more progressive and have established systems like inclusive employment and female-supported working conditions. Things are improving here, but women in STEM is still a new concept and we need to improve on basic infrastructure to accommodate women in this field.

Tell us what you enjoy most about your job?

I love that my portfolio is so diverse. I lead eight different departments whose responsibilities are vastly different, and yet need to work seamlessly together. The Environmental Department is my greatest passion project because I want to ensure that my mine hasn't polluted the environment and leaves a positive legacy. I want to be part of the solution, not the problem.

What message would you like to leave with the future generation of female engineers?

Use your formative years to learn, gain experience and develop your technical expertise to solidify your credibility. Find a mentor who will challenge your thinking, demonstrate leadership and guide your development in the right direction. Finally, be bold in your pursuits and remember you are powerful beyond comprehension and capable of achieving your highest goals. Unleash your inner power and let it shine!

JOURNEY 14

DEFY STEREOTYPES AND NEVER CONFORM

Smita Francis

*Coordinator Namibia Institute of Space
Technology, Namibia University of
Science and Technology*
NAMIBIA

Smita, let's start with your first memories of becoming aware of engineering as a concept. We believe it's a delightful story.

I don't remember exactly when I became aware of engineering specifically, but I do recall being intrigued with how our radio at home worked at a very young age. This was sparked by my elder siblings who told me that tiny singers, musicians and the radio DJ were sitting inside the radio set, playing music.

One day when no one was around, I pulled up a stool, climbed on it and tried to push the radio over so that I could get to the back of the set and meet the people inside! The first attempt was unsuccessful. However, one day I managed to push it off the shelf and when I saw the scattered

bits of mechanism inside, I realised the story my siblings made me believe was not true at all!

Even though it was a bit disappointing, it also sparked my curiosity about how such things really worked and were put together. I belong to the generation that witnessed valve technology being replaced with transistor technology, and it all started with that radio.

How did people around you react when you announced that you wanted to study engineering?

My classmates were quite amused, and I'm sure they made fun of me behind my back, as others opted for medicine, science, business and accounting. My siblings tried to persuade me to join them in the field

ABOUT THE AUTHOR



Dr Smita Francis has a doctorate in electrical engineering from the Cape Peninsula University of Technology in South Africa. She has more than 30 years of academic experience lecturing at universities in Asia, Southern Africa and Germany. She currently heads the Namibian Institute of Space Technology at the Namibia University of Science and Technology in Windhoek. She has published research papers in reputable journals, is an authorised reviewer for several journals and education policy and heads several bilateral research projects.

She is the founder and chair of the Namibian Women in Engineering Association and was awarded the National Award from the Sam Nujoma Innovative Enterprise for ushering in innovative methods in capacity development. Smita is the immediate past president of the Engineering Council of Namibia and the first woman to be elected for this post. She is a prominent member of the Engineering Council of Namibia.

of medicine and ease the tension at home, but to no avail. My dad was supportive of my choice and we even discussed the choices of specialisation, which made me feel more confident.

What life advice did you get from your parents or other important figures in your life?

My parents told me, “Don’t imitate or try to be a carbon copy of anyone else. You are unique, so embrace that uniqueness. Each person on earth has a purpose, so find yours. Work, be passionate and dedicated to that work.”

My Grade 4 maths teacher made a lasting impression on me. One day in class she said to me, “Just because you are a girl, don’t let the boys bully you! Stand up for yourself. If you don’t, no one else will!” She was right, and I have lived by these wise words during my studies, career and other parts of life.

Especially as women, we need to stand up for ourselves and learn that we don’t need to conform to society’s expectations of us.

Where were you born and raised? Did you stay in one place or move around a lot?

I was born third in a family of six children in Amravati, a small town in India. The beauty of my childhood was constantly relocating, as my dad was transferred every few years. It was an adventure! We never lived in one place for more than four years at a stretch, and it was exciting to meet new people and make new friends in all the different places.

What profession did your parents have?

My dad was a university professor who taught genetics, and my mother,

as was the norm in those days, a stay-at-home mom. My father was Hindu and my mom was Christian. I was born into a family that valued a child's education and independence, whether male or female. My parents were very supportive of our education and supported each child in their quest for education and eventual specialization.

Were you interested in becoming an engineer when you were growing up? If yes, what did your family say?

My elder siblings all chose the field of medicine, but when my turn came, I wanted to study engineering. This led to a heated debate between my parents, with my mom furiously opposing it, but I was adamant and had my dad's support. It was a challenging and tense situation at home during this decision process, but my dad succeeded in persuading my mom to let me be.

What were some of the challenges you faced as a woman in order to become successful?

Being a woman in a "man's world", I had to strive daily to prove myself in every task I was given. I experienced a condescending and somewhat patronising attitude from my male counterparts. I've been branded as someone who couldn't make friends easily. If I spoke out or objected to any issues being discussed, I was labelled as arrogant and uncooperative, with stereotypical patronising and sexist comments, such as "It must be that time of the month ..." That's been hard. I feel that if one pushes back professionally as a woman, you often get stigmatised. But I have learnt to ignore naysayers and trust myself more.

Can you pinpoint specific examples of obstacles women face in the sector?

Female engineers have to be strong and motivated at all times to achieve success. There's the fear of going on maternity leave, only to return and find male colleagues having been promoted. Something as simple as wearing a hard hat that will not accommodate a female hairstyle is overlooked and women will be asked to make other arrangements. Never has an employer tried to advise the manufacturer to ensure that the hard hats are designed to be more female-friendly. It's the same as the lack of caregiving facilities for younger children in most places of work. So, it's tough.

Share with us an overview of your journey, from studies to your first job and then on to working in academics.

After completing my master's degree, I started my first job, where top management was adamant that a female engineer would bring with her the perceived complications of women in careers – becoming pregnant, having kids and needing time off to fulfil a role as a mother and wife.

The pressure was too much, so I quit. I then started my own small company that specialised in design, but marketing was an issue, so I chose to join the academic field. This was challenging, as there was not much of an age difference between me and my students, and some were my friends too. I remember my first lab session with the second-year engineering students – suddenly we heard animal sounds from one corner of the lab, and it moved from one corner to the other.

I decided to pretend that I was engrossed in marking papers, but kept on checking the students at the corner workbench. Finally, I identified the

student and called him to the front of the class. He looked sheepish and confused. I said to the class, “Can I have your attention for a minute? This student will entertain us with his gift of making animal noises.”

The student was flustered and embarrassed, so he just apologised and we all were on good terms until they graduated. Sometimes we need to stand firm and not be intimidated in order to gain respect, especially as a female lecturer. I am very proud of how I have been able to achieve that.

When did you move to Africa, and do you think of yourself as African?

I have lived in Africa for almost three decades. I feel myself to be fully African at this stage, as I have lived and worked throughout this wonderful continent.

When newly married, my husband suggested that we move to Zimbabwe, where his sister lived. I had been with Siemens in Mumbai after graduation, and then worked as head of department at an engineering college for nine years, so it was tough to leave. I was happy teaching in Pune, about 180km from Mumbai.

But off we moved to Masvingo in Zimbabwe! And then we split up. There I was, a single mom with two daughters in a foreign country and I had to make it work! What choice does one have?

Later, I ended up in Namibia and I've been here over 20 years. My daughters are now all grown up and have children of their own. I have four cute grandsons (two in Germany).

What values do you bring into your home and impart on your children

and family, being a working woman in the field of engineering?

Punctuality, dedication, keeping a diary of all the work to be done for the day – planning is key! General knowledge and reading were also a must and we encouraged it greatly in our home.

We understand that women in engineering and related fields can still be seen as unorthodox. How do you see your role and responsibility in encouraging women in these fields?

Every female engineer serves as a role model to encourage and motivate female learners to enter the field. Realising this, and being tired of being in the minority, I started the Namibia Women in Engineering Association (NWEA). We organise workshops, seminars and outreach activities to motivate young learners to join the engineering and wider STEM arena. That's been very gratifying. Women must raise other women up. It's the first step towards changing things and closing the gender gap in our sector.

What do you think needs to change for the environment to be less hostile towards women?

Educating society at the grassroots level and changing the thinking and perception of that society to accept women in sectors traditionally reserved for men. Women also need to be more respected in leadership positions and roles of authority.

What matters most to you in your profession or workplace and which unique perspectives do women bring to academic or industry jobs?

Job satisfaction and equality are very important to me in the workplace.

Women are deeply creative and innovative. We analyse a problem taking into consideration many issues and we think holistically, which is very valuable in the sector. I believe we are unique across many aspects of how we conduct ourselves and how we carry out our duties in the workplace. I think we work harder because we feel we have more to prove.

Has your commitment to your job or capabilities in your role ever been questioned based on your gender?

All the time! I would for instance make suggestions during meetings and then none of it would be captured in the minutes. I had to be assertive in these instances and make sure my voice was heard.

Has the perception of society regarding working women changed with time?

Yes, it has improved, but there are many diehards who are sticking to the old perception that women must work, come home, cook and take care of the household chores, including looking after kids. But we do not need to conform to these stereotypes. I certainly didn't and I am so glad for that.

What is your one big dream for women in the workplace in modern society?

To see an engineering university created only for females. That would be an amazing place!

Tell us what you enjoy most about your job. Tell us about your inspirations and aspirations, your struggles and victories. And what is your message to all the women who need to hear that they can.

I really enjoy witnessing the personal development and creative and

innovative thinking the students develop by the time they reach the final year of the engineering course.. I have seen young students entering varsity unable to have a conversation in English and unable to use a computer. Gradually they start blooming into proud, capable engineers.

One day at Cape Town International Airport I was in the lounge waiting for my flight and a tall, strong-looking young man walked up to me. He greeted me, offered me a coffee and a doughnut and started a conversation. I didn't know quite what to make of it.

Finally, he said, "Ma'am, I see you don't recognise me." I had lectured him ten years ago in Zimbabwe and today he is part of the UN! Another student is a director and in charge of the Angolan space programme. It gives me great pride to see my ex-students so dedicated to their work and not forgetting their lecturers.

Another of my students, who hailed from a rural background and whom I took under my wing, came to me after graduating and landing her first job. She sat down and then offered me an envelope she implored me to open. When I did so, I found a wad of dollar bills. I asked her why she was giving it to me. She explained that it was her first salary and she wanted me to have it, as without me she would never have graduated successfully and found a job.

This brought tears to my eyes. It was such a special and poignant moment. Naturally, I could not accept the gift and encouraged her to give

it to her parents, who lived a simple life in a rural village.

Things like that make my life's journey all worth it – knowing you have had an impact and helped people become the best versions of themselves, fulfilling their potential.

JOURNEY 15

HARNESSING (AND SUSTAINING) POWER

Fihiima Mohamed Hassan

Founder of F&H Solar

SOMALILAND

Fihiima, thank you for taking the time to speak to us. We are excited to hear more about you and your exciting career as a young female engineer in Africa. Tell us about your work experience and your current role in Somaliland.

I am an electrical engineer with an MBA in project planning and management. I have four years' experience working as an electrical engineer in control and protection systems, as well as with solar systems in the Mohamed Mooge region of Somaliland. My special interests are electrical systems and generation, transmission and distribution. In 2019, I founded

my own company, F&H Solar, which focuses on developing compact, sustainable solar systems for rural communities in Somaliland that can't afford high-cost electricity. The company is named for me and my classmate, Hibo, who started it with me.

ABOUT THE AUTHOR



Fihiiima Mohamed Hassan was born and raised in Hargeisa in Somaliland. She is an electrical engineer with an MBA in project planning and management. She has worked for four years as an electrical engineer in control and protection systems. She also works with solar systems and grids in the Mohamuud Mooge region. She has vast experience using electrical systems in generation transmission and distribution. Her electrical design entails planning, creating, testing

and supervising the development and installation of electrical equipment, including lighting equipment, power system components and safety systems. She also designs home installation and solar systems in the commercial and industrial sector.

Fihiiima works in technical operations at the Bacado main power station project and the Badacas project and overhead and underground transmissions design at the Sompower Company. She designs new distribution lines in Somaliland.

She has attended different discussions about how to improve electricity in various energy sectors. She is fully trained in field wiring and basic circuit laws. Fihiiima has participated in multisector energy and electrical discussions with institutions such as ESERS USAID (GEEL). She has also participated in energy support with a focus on transactional support, investment in the energy sector and the rearrangement of infrastructural distribution systems.

In 2019, Fihiiima founded her own company, F&H Solar, which focuses on rural areas in Somaliland that cannot afford high-cost electricity. She also established the Women in Power and Energy Association (WPEA), which focuses on employing and granting rights to young female engineers.

Your role is extremely varied – what are your specific areas of expertise in the engineering sector?

Yes, my role is quite diverse. It includes designing solar installations for residential homes as well as solar systems for commercial and industrial sectors. I also work on technical operations on the power station project at Bacado. Before starting F&H Solar, I worked at the Sompower company on overhead and underground transmission designs, as well as designing new distribution lines. I also participate in multisector discussions with institutions such as ESERS USAID on electricity and resource management.

Can you tell us about your personal contributions to other aspiring women in the engineering sector?

I am passionate about empowering the female engineering workforce. That's why I established the Women in Power and Energy Association (WPEA). This organisation works for young female engineers to fight for their rights in the engineering field and to help open doors to opportunities and jobs in the energy sector. I am dedicated to empowering women in the field. In essence, I am all about harnessing and sustaining power – both solar and female!

Can you share a bit about your background with us? Where are you from?

Somaliland is where I was born and grew up; in Hargeisa, the capital city. This is where I have spent most of my life. I decided I wanted to focus on creating my own history here, in the country and city of my birth. Both my parents are still alive. My mother got married to my father at an early age. He was part of the army police in Doha in Qatar. I have one brother

and three sisters. Our parents never differentiated between us as we grew up. They love and support us all equally, as do we one another.

What advice did your parents give you while growing up that you remember and live by?

My parents always told us that education was the key to achieving success in life. They were supportive of my education every step of the way. The most valuable advice my parents gave me was to always strive to improve my education to the highest level possible, to focus on self-improvement, to create something different and to be a leader for young generations.

Did you enjoy school and when was your interest sparked to go into engineering?

When I was in secondary school, I really enjoyed chemistry, maths and physics, which sparked my interest in nuclear as well as electrical engineering. This interest eventually manifested into my dream career. I recall my father telling me that as I was a girl, I should become a nurse or go into healthcare. He said engineering was a male sector, and I remember feeling bitterly disappointed by this.

When I finished secondary school at Noradin Girls High, I was determined to enter the field of engineering. Fortunately, my parents were all for furthering my education, as opposed to getting married and starting a family at a young age.

It's inspiring that you followed your dream to become an engineer – tell us how your studies played out so that you could achieve this dream.

Straight after school, I started my bachelor's degree in electrical engineering, which lasted five years, at the University of Hargeisa. The ratio was five males to every female, which was to be expected in the Engineering Department at that time. My lecturers and faculty members treated me well; they really believed in me and my capabilities. The campus was safe, clean and had amenities all geared towards accommodating women, which was a big plus.

During my studies, I felt I wasn't getting enough practical experience and decided to improve my technical skills. I did so by studying part-time at Hargeisa Technical School over four months. I then went on to start my first internship, at Sompower. I started working as a technical operations professional in the electrical engineering department.

Soon after completing my bachelor's degree in electrical engineering, I started my postgraduate studies at Amoud University – an MBA in project planning and management. This really set me up and allowed me to turn my dream job into a reality.

What challenges did you face when entering the field of engineering?

As a female engineer, I faced (and still do!) numerous challenges and obstructions. When starting out, no one wanted to work with a woman or have her on staff as a permanent employee, as they believed men were better suited for the role of an engineer and women were meant to be secretaries. This was disappointing, but in the end I overcame these challenges, and that is why I find myself where I am today. Never give up on your dreams, I say!

Was it difficult to break into the job market once you'd completed your studies?

After I graduated, there was a lot of gender discrimination at first, especially when I went on site visits or to power stations. The operators would differentiate between the men and women, telling us to just stand back and watch.

It was difficult for me to get permanent work in my field. Large companies that generate electricity don't agree that women can work in our male-dominated industry. That is when I started the WPEA, so that women could find their feet in engineering areas, whether at university, in workplaces or in the broader energy sector.

Electricity costs in Somaliland are some of the highest in Africa. It's however also one of the richest regions in terms of renewable energy resources. Solar energy resources in Somaliland are almost uniform, with only minor seasonal variations. Due to these natural advantages, I thought of utilising the potential of our country to benefit the people who cannot afford expensive electricity. Instead of battling with gender bias in the workplace, I created my own opportunity and haven't looked back.

Tell us about your vision and aspirations for your country, and how do you see your role in that?

My vision is to bring affordable, clean and reliable electricity to rural and pre-urban communities in Somaliland, with the hope that communities will use electricity to harness and utilise their local resources. An example is increasing agricultural productivity by providing affordable energy for irrigation and increasing electricity connection to rural social services like

health clinics and schools.

Do you believe women face more difficulties to succeed in such a male-dominated sector such as engineering, and more specifically in Somaliland?

Absolutely, especially in Africa and particularly in Somaliland. Our culture hinders women from doing technical or engineering jobs. What matters for me in my profession or workplace is to achieve equality and acceptance without gender bias. These sentiments extend to places of study and among the community. I do my best to fight for women's rights to pursue engineering, whether in education or in the workplace.

What are some of your personal inspirations, in life and in your work?

My work makes me happy and content. Working on something you are passionate about is so important. My inspiration comes mainly from my mother – she was always by my side, encouraging me to be different and unique. She always told me I could achieve whatever I set my mind to, and to always trust in Allah.

Can you share a concluding message for other young, aspiring female engineers?

My message to the strong young female engineers out there is to not allow anyone to destroy your dreams and hopes of becoming a professional engineer. You are the one who can create your own destiny!

You don't need a man to help you get there. Focus on improving your technical skills, learn more skills than you feel you need in one area to

improve yourself in others. It is our time, as women working in the energy sector, to get over the hurdles placed by society and create what we want. Harness your power. Sustain it and empower others in doing so.

JOURNEY 16

WATER ENGINEER WITH A PASSION FOR FILMMAKING

Bancy Mbura Mati

*Professor at the Jomo Kenyatta University
of Agriculture and Technology*
KENYA

It's such a privilege to pick your brain about your journey as an African female engineer. Tell us about yourself and your various professional roles.

I am a professional water engineer who started off as an agricultural engineer at a BSc level and did a land and water management degree at a master's level. I hold a PhD in agricultural engineering, food production and rural land use. I currently work as a trainer, researcher, consultant and development worker in the fields of water and land management, irrigation, water harvesting, food systems, drought resilience, climate change adaptation, policy and institutional frameworks, project formulation, evaluation and management.

Any professional accomplishments that you are particularly proud of?

I was the first female agricultural engineer in Kenya, and the first woman to become a full professor, consulting engineer and fellow of the Institution of Engineers of Kenya, all rolled into one. I have a particular passion for water management, to which I have dedicated my life and effort through various projects and initiatives. Some are done, others are

ABOUT THE AUTHOR



Professor Bancy Mati has over 30 years' experience as a professional engineer. A professor at the Jomo Kenyatta University of Agriculture and Technology (JKUAT) in Kenya, she is also a director at Resource Plan, a consulting firm based in Nairobi. She holds a PhD in agricultural engineering, food production and rural land use, an MSc in land and water management and a BSc in agricultural engineering.

Bancy is a registered consulting engineer, a fellow of the Institution of Engineers of Kenya (FIEK) and lead expert in environmental impact assessment. She previously worked with ICRISAT as programme manager of IMAWESA, and with IWMI. She has consulted for WFP, FAO, IFAD, UNDP, the World Bank, NEPAD, AGRA, AfDB, IWMI, ILRI, ICRAF, EAC, Sida and MENR.

Bancy also serves on the steering committee of the United Nations high-level panel of experts on food security and nutrition (HLPE) and is the chair of the Association of Irrigation Acceleration Platform (AIAP). She is also on the board of the Upper Tana Nairobi Water Fund and Kenya Water for Industry Association. She previously served on the boards of the United Nations University's UNU-FLORES, the National Biosafety Authority, the Engineers Board of Kenya and the Global Water Partnership. She has authored over 160 publications, including books, book chapters, journal papers and reports.

ongoing, yet others are in the pipeline. I am very proud of what I've done, what I am doing and what I hope to still do.

Tell us something people may find surprising about you.

Apart from my career as an engineer, I am also an award-winning documentary filmmaker. In addition, I made my own self-funded feature film! I love making movies.

That sounds intriguing – please tell us more about these projects?

I wrote and produced a set of nine documentary films on land and water management in Kenya, Tanzania, Ethiopia, Malawi and Rwanda. In 2013, my documentary film on the SRI (System of Rice Intensification) project (I introduced SRI in Kenya in 2009), won first prize in Africa, awarded by FARA (the Forum for Agricultural Research in Africa). That was another proud moment for me.

A year later, I also wrote, directed and produced a feature film, *Performers not wanted: an African musical experience*. It's a musical that narrates the challenges of a rural performing group with immense talent. It premiered at the Boma Hotel in Nairobi in November that year and made the group from the Evurori Multicultural Centre who star in it quite famous!

Filmmaking is really gratifying. I will make more films when I can. Science is how I make a living, but writing and filmmaking are passions. It's also great when the two converge!

On your website, you describe yourself as “water management expert, consultant, writer, project planner and implementer, policy expert, film producer, hard worker and go-getter”. A real

all-rounder, by all accounts! How do you find the time to make it all happen?

Ha! Ha! Ha! To tell you the truth, I work about 18 hours a day. I love what I do.

You know, people think of engineers as boring, but we are far from it. I don't believe in limiting myself. I keep exploring and challenging myself and explore my different talents and areas of interest. That is what keeps one young, I think.

You know, my grandmother lived to be 110 years old. We attribute this to the hard, physical labour she continued to do in the rural village where she lived. It kept her fit, healthy and strong. I like to use my mind in the same way and hopefully it will keep me going too.

Where were you born and raised?

I grew up in a rural village in Mbeere in the eastern part of Kenya. When I was 13 years old, I left for boarding school, and thereafter I went to university. As a young girl in our small village, I remember playing games with my friends. It was a simple yet fulfilling life.

Tell us a bit about your parents and what they did for a living?

My parents were small-scale farmers. They also ran a "hotel" in the local market centre. My mother was a great businesswoman and her hotel thrived. My siblings and I were brought up never to expect anything handed on a silver platter. My parents instilled a sense of hard work and encouraged us to pursue education, as they knew it was the only way out of poverty.

Did your parents differentiate between you and your siblings in any way with regard to gender?

Yes, they did, mostly in response to cultural pressures. As teenagers, my brothers could come and go as they pleased. This leniency was not applicable to me – I had an 18:00 pm curfew. When it came to education, though, my parents encouraged us all equally. They also expected my brothers to do so-called feminine work, as it was seen in our culture, to share the workload with me. I had two older brothers, and five younger siblings. Because of this large family dynamic and hierarchy, I also learnt to take on lots of responsibilities at a young age.

Can you remember the first time you became aware of engineering as a concept and career choice?

I do remember, surprisingly! As I grew up in a rural village, I'd never heard of an engineer, let alone seen one. After I started high school, I became aware of engineering as a subject through the school careers programme. I was top of my class in mathematics and science, which also helped me decide to venture into engineering. I knew for sure it was what I wanted to study by the time I was doing my O-level exams.

Another influence was my brother. He joined an agricultural college and his best friend was an engineer. I never met the friend, but the way my brother talked about him and what he did seemed fascinating to me. There was something that appealed to me about doing a tough job, yet being in the green space of agriculture. Agricultural engineering was my first choice, and here we are!

How do you feel others perceive you in your role as an agricultural engineer?

People who don't know me and my work take me for granted. I am rather ordinary in stature and it's not important to me to prove anything to anyone. I am comfortable in my own skin. I do not have that powerful first impression some people are gifted with – you have to give me a task to appreciate my worth. Sometimes one loses opportunities because people are judgemental.

Were you able to find a balance between work and social life at university?

I really enjoyed my studies. Academically, I excelled in all my courses, even if I do say so myself! However, socially, it was difficult. Can you believe that I was the only woman in my agricultural engineering class of 30 students? I was fortunate that male students be treated me with the utmost respect. Outside of class I had very little free time to socialise with other women my age, so I guess you can say it was fairly imbalanced.

Tell us about your four children?

I got married during my second year of university and became pregnant soon after. I wrote my second-year final exams while heavily pregnant. In fact, I gave birth a week after the exams! He became a mechanical engineer and works for an engineering consulting firm.

In my third year, the university closed due to riots, and during that time I became pregnant again. To keep up, I wrote my exams when I was eight months pregnant and a month later our baby daughter arrived. She became a civil engineer and now heads an international NGO in Nairobi.

I have a theory: I think all the reading and studying I did while pregnant

with my first two children had a direct impact on their brain development. Consider this: I later became pregnant and gave birth to another boy and girl in a relaxed, low-stress working environment with ample maternity leave. These two were not interested in science at all! My son works in tourism and my daughter in marketing. So my advice to female engineers is that they should try becoming pregnant during their engineering studies!

Did you continue with postgraduate studies after receiving your first engineering degree or did you find work immediately after graduating?

I first got a job and worked for several years before deciding to go ahead with my master's degree.

What was the environment like at your first place of work?

My first job was challenging. I evaluated soil conservation projects and had to travel around the country, but had a young baby and family to consider. It was so difficult that I quit during my second year and pursued teaching. I didn't enjoy it at all and really missed my previous job. It was a sacrifice I had to make for my family. I feel it's a challenge for any woman to juggle work and family, no matter what career she chooses.

How did your family and society react when you officially became a qualified engineer?

My family has always been supportive, including my husband, so I am lucky in that regard. Society places pressures on us all, but I did not feel any negative reactions towards me or my chosen career.

As a Kenyan woman, tell us about the dowry system and share

your experience and thoughts about it. Also, is there a strong bond between your two families – yours and your husband's?

In our culture, all women are considered equal and the dowry is the same for us all – whether educated or not, beautiful or less so, young or old. Quite simply, it is 72 goats. These goats must never all be paid during the lifetime of the woman. That way, no woman in my culture is fully paid for and that debt is what makes it a friendship bond, not a bride price. I believe it is quite beautiful.

In today's contemporary culture, much of this has changed and it is not always applied. By the way, the woman in question is not supposed to know how many goats have been paid or are pending. But there is a down payment of a mandatory three goats for the creation of the “covenant” that binds the two families. This covenant between the two families is cemented with the exchange of gifts, and it should not be confused with the dowry or bride price, as understood by Western cultures.

The covenant between our two families was done in our absence – neither me nor my husband were required to attend. I had a white wedding in church. The two families are very close and supportive of each other, which is wonderful.

What unique perspectives do feel women bring to academic or industry jobs?

Women most certainly have an eye for detail, they possess empathy and get things done diligently. We all know that women are also good multitaskers!

How do you balance work and personal life, especially as a mother?

Finding the balance is not easy. I definitely allocate more of my time to work. I make sure I attend all important family events, do the family shopping and supervise the household activities. I love doing it all, as my family is so dear to me and it's for their sake that I work so hard. I think most working mothers would agree.

Do you feel empowered as a female educator?

To a point, but not in the same way as men feel empowered and are looked up to by their colleagues and society. There are still too few women in top positions and my wish is for this to change.

Has the perception regarding working women changed over time from a societal perspective in Kenya?

Yes, I believe it has. In Kenya, women are expected to work and earn a salary to succeed in business, similar to men. I feel that's fair and just.

What is your hope for women in the workplace today?

My vision for women is to be able to carry their babies to work and to find the support they need to be both mothers and pursue their careers, at the same place.

Bancy, tell us what you are busy with currently?

I believe I am a seed: I plant ideas and grow them into something much bigger. An example of this is my most recent startup, which is just a year old and creates a knowledge platform of stakeholders engaged in the irrigation sector in Kenya. It's called the Association of Irrigation

Acceleration Platform (AIAP).

I will continue to grow and thrive in the engineering sector and encourage the women of Africa to do the same and to follow their dreams.

JOURNEY 17

FASHIONISTA ENGINEER

Trudy Morgan

President of the Sierra Leone

Institute of Engineers

SIERRA LEONE

Your story is one of inspiration and a prime example of hard work that is really paying off for someone who has put in the time and effort for what they have achieved. Let's start at the beginning: where were you born and raised?

It's an honour to share my journey, and the beginning is always a good place to start. I was born in Liverpool in the United Kingdom, where my father studied for his master's degree while my mother did her midwifery training. I spent a good part of the first two years of my life with English foster parents, while my parents completed their studies. I was too young to remember, but I later realised how much my parents sacrificed for our family while furthering their education.

Did your family move around a lot?

We certainly did! My family is from Sierra Leone and so in 1968, when I was two years old, we returned home to Freetown. Later we moved to Ghana, where my father went on to teach at the University of Ghana in Legon.

In 1973, after the birth of my two sisters, we moved to Canada, where my dad went on to do his PhD in environmental biology at the University of Guelph. My mother also completed a degree in sociology at the University of Guelph during this time – while pregnant. What a pair of go-getters!

At the end of their studies in Canada, our family relocated back to Sierra Leone, where my father was employed as a lecturer at the Zoology Department at the University of Sierra Leone. In his laboratory all you saw were bugs, an animal foetus or two in a jar, then more bugs! He loved insects.

Today he is pro-chancellor at the University of Sierra Leone. I am very

ABOUT THE AUTHOR



Trudy Morgan is the first African woman to be awarded a fellowship from the Institution of Civil Engineers and the first female vice-president and first female president of the Sierra Leone Institution of Engineers. She has over 30 years' experience with project-based assignments, successfully applying her engineering, consulting and project management skills to a wide range of business problems to enable the implementation of practical and cost-effective solutions. She has worked in the construction, health and transportation sectors and delivers project management expertise to public and private sector clients as well as international development organisations.

fortunate to have both my octogenarian parents still with me – Prof Hector Goddard Morgan (85) and Mrs Marion Morgan (80) this year!

My parents loved to travel, so we spent most holidays visiting different countries. We have had trips on ships, in airplanes and via road. My life-living parents instilled that travel bug and love of exploration in me. I feel really fortunate and happy to have seen so much of the world. It was a great upbringing, and I was exposed to wonderful ideas and magnificent cultures.

Tell us about your sisters and the bond you share?

I have three sisters and as the eldest I was taught to support and take care of my younger siblings. I took responsibility for their actions and as a result I bore the brunt of any punishment handed out, much to my dismay.

I was regarded as a maternal figure by them all – my youngest sister called me “mommy” until she was five. I was also the one they would gang up against. I recall the time they locked me in my room and threw darts at me through the window. But they love me, I promise!

My sisters are all exceptional and have achieved a lot. The second eldest, Yvonne Aki-Sawyerr, OBE, is the current mayor of Freetown and holds a degree in economics and a master’s in international development. My third sister, Dr Marion Deigh, is a medical doctor and works for the National Institutes of Health (NIH) in the USA. My youngest sister, Barbara Jane Morgan, is a biochemist who manages regulatory policy and acts as risk management advisor for Health Canada. I’m extremely proud of all of them.

Did you always want to be an engineer?

In high school, I actually wanted to be a doctor, but then realised after

working at my uncle's surgery during one school holiday that the sight of blood made me nauseous, so that aspiration went out the window!

After secondary school, I joined a band and wanted to be a professional jazz singer. In my youth, I used to sing in gospel choirs and bands. I loved it. My father made a deal with me, though: he said if I completed my first degree, I could choose any career I wanted. He valued education and instilled its importance in all four of his daughters. Today I am grateful that he did that, although a part of me is sometimes sad that I didn't explore music further. But becoming a civil engineer was definitely the right choice for me. And no one can stop you singing for pleasure, which I do a lot of! I have been in several gospel choirs, toured with a few celebrity singers and still sing with a group called G7, here in Sierra Leone.

When did you decide to become an engineer and what encouraged this step?

My father nurtured my decision to study engineering. I agreed to go to university and my father used the fact that I would be able to "draw" during the course to entice me into engineering. Once I started the "creative drawing", I soon realised it was not the type of drawing I was expecting. His plan worked, though. My father is a great strategist and a brilliant parent.

Did any family members advise you on what was considered a more female-appropriate and less male-dominated career path?

Some family members felt it wasn't an appropriate choice, but my father quickly put them in their place. The fact that he also worked at the university helped the decision-making process. It was an organic choice

that made sense to me.

How did your family and society react when you officially became a qualified engineer?

With great pride. Engineers don't always understand the value they bring to society and the world at large. I became a Chartered Engineer in the UK and was amazed at the way my colleagues started to view me professionally. I had joined a small group of individuals who could boast of having attained professional recognition in the UK.

When I became the first black African female fellow of the ICE (Institution of Civil Engineers), I had congratulatory messages from all over the world. That accolade made me and my family extremely proud. I am now the first female president of the Sierra Leone Institution of Engineers, and my family was there to support me during my inauguration. I currently sit on several boards representing engineers nationally and internationally, and I believe I have been able to make my family, my community and my country proud.

Did you receive sound advice from your parents or other family members?

I grew up in a family who constantly gave advice (and still do!). As Africans we speak in parables, and we never had a doubt as to what was expected of us. My immediate family supported me and gave me invaluable advice throughout my studies, which continued into my career. Some of my more conservative family members opted to lecture me on the duties of a woman in society and felt this was more important than forging a career.

This was to be expected but didn't deter me from following my heart and fulfilling my goal of becoming a civil engineer.

What kind of dogma did you have to fight to get to where you are now?

There is a belief that women are unreliable investments because they end up getting married and having children. There is a warped perception that motherly duties will then prevent them from being good employees. There are many more misconceptions and gender stereotypes: women love to gossip, women can't work with other women as they get jealous, women can't lead men, women are too aggressive and like to take charge, and so on.

I also had the challenge of race. While I was in the UK, I was often the first black woman most engineers had ever worked with at a senior level. Some felt I couldn't be trusted to deliver, I couldn't be a leader, I wasn't smart enough to handle work pressures, I could not be put in front of clients as my hair braids would not be acceptable ... the list goes on.

Were you ever encouraged to get married instead of following a career?

My mother definitely encouraged me to get married. She was worried that I'd never get married, and as a traditional African mother that was important to her. To her dismay, I'm still not married! Some say African men are afraid of strong qualified women. To be honest, I don't blame them! That said, I am very much a woman. I love looking good and wearing fashionable clothes. I am social and outgoing and I love throwing parties.

I don't believe the two are mutually exclusive. I have the privilege of

working with some of the most dedicated female engineers who balance work and family in the most enviable manner. Women are blessed with the ability to prioritise and multitask!

Can you recall the ratio of men to women during your studies at university?

When I started university, there were only four women to 50 men. When I finished my civil engineering honours programme, I was the only female, with eight males. This has changed considerably over the years, as more young females in Sierra Leone choose to study in this previously male-dominated area. But the percentage of female engineering students is still rather low.

How were you treated by fellow classmates and faculty members at university?

I was very social (perhaps a slight euphemism!) and enjoyed going out, which was often frowned upon by my lecturers. Some felt I didn't take the course seriously enough. I believe in finding a balance between playing hard and working hard.

During my first year at university, most of my friends from secondary school had left Sierra Leone to complete their education abroad. I was able to make new friends, some of whom were not from the capital, and it was interesting to note their view of women, which was in total contrast to the way I was raised. Overall, my male counterparts treated me well because I was able to match them academically. I think I continually shocked them with my ability to party and still pass exams!

Tell us about student life and the University of Sierra Leone.

The university was located at the top of a mountain and in those days it was picturesque, with lots of flowers and trees across the campus. Now it's all concrete. The engineering faculty was located at the edge of the campus and engineering students had to walk across campus carrying our drawing boards and T-squares. We did so with pride, as we were seen as the smart ones who did amazing things.

Engineering students had the most challenging schedule, with late classes and laboratory work over weekends.

My life at the university, from 1984 to 1989, was so much fun! Most students stayed on campus and my friends and I would regularly meet at a popular spot called Bos Tik (The Talking Tree) in the centre of the campus where the term “provoke” was taken to a different level. You had to be tough to hang. There were several fraternities, sororities and social clubs that held beautiful formal dinners and all-night parties. My ability to speak in public developed there, as I was regularly asked to make speeches or give toasts.

In my final year, I was president of one of the most prolific social clubs on campus. This meant that I sometimes would leave parties and go straight to class on a Saturday morning. As you can imagine, this didn't sit well with my lecturers!

Music was also part of my life at university and I was a member of the choral society that held concerts once a term. In those days, I was never bold enough to be a lead singer, but sang with a lot of attitude in the front row!

Outside of life as an engineering student, were there any interesting

incidents that happened to you during these years that you would like to share?

In my first year, the wife of the American ambassador asked me and some friends to model clothes for a Rotary charity fundraiser. I reluctantly agreed, but must say I really enjoyed the experience – balancing books on my head, speaking to myself in the mirror (“I am beautiful, no matter what anyone says”), doing aerobic exercises for the first time and, of course, the clothes! My friend Romelle calls me the “fashionista engineer”, and I still like to see myself that way.

I knew that I loved clothes but during this time, I was spoilt for choice. This gave me the opportunity to start modelling semi-professionally, earning me extra money throughout university. Later, I started designing and sewing my own outfits, which meant I could experiment and be more whacky in my approach to dressing, engineer or not! My sister and I would spend hours sewing an outfit for a party and wear it that same night.

The university had three major “houses” and everyone on campus belonged to a house. I belonged to Bai Bureh and because I was athletic, I was elected their female games captain in my final year.

Nicknames are common at university and I earned mine in the first year. I participated in the annual sports day and my friends nicknamed me “Chuchumogs” – apparently when I ran, I looked like a train, hence the chuchu added to the first syllable of my surname. There are people

who still affectionately call me Chuchu, Chuchumorgey and Chuchumogs.

Do you think things have changed for the better for the present generation in Sierra Leone?

On some levels, such as advancements in technology and access to information through the internet, things are much better. On the other hand, the university is in a state of disrepair and students can no longer stay on campus. With increased student numbers, they fight to get on the few buses and taxis that travel to the university.

There are power cuts and issues with water. A large number of the lecturers are part-time and most have other jobs, which means they are unavailable to students when they are needed. In the context of an emerging economy, I personally don't think things have changed for the better. Primarily, the foundation of our students is not strong enough to allow them to fully benefit from an engineering degree without significant additional assistance.

Did you continue with postgraduate studies after receiving your first engineering qualification, or did you break into the job market immediately?

I started working straight away. After finishing my degree, I left Sierra Leone and went to the UK and got a job at Sir Robert MacAlpine & Sons within two months. This would be very difficult for our graduates these days. I topped up my degree with modules at Kingston University and

completed an MBA from the Cranfield School of Management in 2000.

I loved my time at Cranfield. I had been working non-stop since 1989 and made sure I worked, played and partied hard. I joined the female rugby team and we travelled to Duke University in North Carolina for the annual MBA Schools Rugby Tournament. Let's just say I won the trophy for the only player to wear lipstick throughout the tournament, and what happens on tour stays on tour!

I partied hard because I was voted in as a social secretary in week one and helped organise almost every party on campus for the year. One of my greatest achievements was organising Africa Week, when over half of the female student body ended up wearing my African outfits on one of the days. I tied a lot of head wraps that day! My year had over 54 nationalities and I still keep in touch with my friends from across the world.

What was your first work environment like and did you face any significant challenges?

I was really excited about my first job at Sir Robert McAlpine & Sons, now McAlpines. My first few assignments were quite challenging. It was 1989 and black women working on site was very rare. I had a tough time for the first eight years. For most people, I was the first black female engineer they had ever worked with. I had to deal with gender and racial abuse throughout my early career. I had staff who would not listen to me. I was threatened and even told I would be killed on site!

I was however always able to find creative ways to get the work done, make friends and influence people. I grew a thick skin and broad shoulders and learnt to listen and “not hear” what was negative, derogatory or cruel. I learnt that not everyone who didn’t smile at me was my enemy and that as an enigma to most people, I had to give them time to learn to trust me as a professional.

In later years, when racial discrimination became a crime, the ways of discrimination became more subtle and sophisticated, and exclusion became the way I was discriminated against. Again, my weapon of choice was hard work, which could not be challenged. My prayer has been, and still is, that my work is efficient and innovative. No one can take that away from me.

What are the challenges female engineers face in the industry today, in your opinion?

The two main challenges women face are sexism and exclusion. Other challenges include less pay, fewer benefits and fewer opportunities for career progression.

Do men treat you differently when they learn that you’re a successful, forward-thinking engineer?

There are still some who try to diminish my achievements. Fortunately, there are many more who treat me with the utmost respect and appreciate what I have been able to achieve.

What unique perspectives do women bring to academic or industry jobs?

The three that come to mind are empathy, intuition and sensitivity. The world needs balance and we bring that to every situation.

We understand that women in engineering and the wider STEM sector, as well as other allied fields, can sometimes still be considered a little unorthodox in more traditional African societies. Do you feel you have a responsibility to encourage women to enter these fields?

Over 50% of the world's population are women, and in a developing nation like Sierra Leone, we need all brains on deck in order to develop effectively as a nation. So yes, I do have that responsibility, and I will continue to work to empower women in this society and others. I am a co-founder of the organisation Sierra Leone Women Engineers, and our sole aim is to encourage and support girls who enter the engineering field, and to support female engineers in the work environment and look to influence policy that will support the development of females in STEM, specifically engineering, in my country.

I feel honoured to be included in a volume like this, which furthers this cause. It's wonderful to represent my African heritage and hopefully be an inspiration to other young women who choose to follow their dreams in a career of their choice.

I love the fact that I can make a difference with the work I do and will also continue to personally encourage women through the Sierra Leone

Women Engineers organisation and other avenues.

What is your hope for women in the workplace in society today?

I'll keep my answer short and to the point: equal pay and equal opportunities for all women of all backgrounds.

Any final insights to share with us, Trudy?

I think the secret to having a successful and happy life is pragmatism. We have to be real and live in our reality, in whatever form or shape we find it. Living in 2021 is very different to living in 1989 and most of us sometimes look back with rose-tinted glasses. We must work to not instill the anxieties and issues of past or present generations into the children of today.

We must be generous and give back – our expertise, our time, our skills. For my milestone birthday in 2021, instead of having a party I bought 100 science kits from Dext Technology in Ghana and held a science fair with 75 students from eight different schools. Supported by the creators of the kits, I held an exhibition with the best students, and this was featured on national television. As a result, one of the schools started a science club and many of these children are so excited about science and are constantly asking me to provide help and assistance in their quest for more experiments.

Finally, I would say to all of us, men or women, boys or girls, trust yourself, be kind to yourself and others and follow your heart.

JOURNEY 18

**SUCCESS IS NOT FINAL AND
FAILURE IS NOT FATAL**

Phideria Clara Moyo

Deputy Director of Water

Supply and Sanitation

MALAWI

Phideria, thank you for allowing us the opportunity to seek insight into your varied life experiences, both professional and personal. Let's start with your background – please tell us a bit about where you are from, and about your family.

It's such a pleasure! I am proudly Malawian, hailing from a small village called Lipunga in the Mchinji district. I am the firstborn and one of four siblings, all girls. Unfortunately the youngest one passed away at the age of 13.

Life became quite challenging for me at an early age. I lost my father at the age of five (my younger sister was then just a year old). Eight years later my mother remarried and had two more girls. It wasn't easy for my mother to raise four girls single-handedly, as it was regarded as a waste

of resources to educate girls, despite the father figure being present. This situation was exacerbated by the rural setting, with only a few social amenities nearby and poor infrastructure. Despite these hardships, my mother worked tirelessly and supported her daughters, encouraging us in our educational endeavours.

In Malawi, like many other African countries, society perceives a women's role to be in the kitchen and raising a family, with little emphasis on forging a career. In that regard, I am grateful to my mother for breaking

ABOUT THE AUTHOR



Phideria Moyo obtained a BSc in civil engineering from the University of Malawi in 2002 and an MSc in water resources management from the University of Luneburg in Germany seven years later. She serves as a board member of the Malawian Engineering Institution. She is also the co-founder and vice-chair of the Professional Women in Water sector in Malawi. She is an active vocational mentor and motivational speaker.

Phideria currently works in Malawi's civil service as the deputy director of Water Supply and Sanitation. She has over 19 years' experience in the water sector. She has been involved in drafting policies and regulations for, among others, the National Irrigation Policy (2016), the National Water Policy (2021), the Malawi Engineering Institution Act (2019), the Water Resources Master Plan (2015) and the Irrigation Master Plan (2015-2035).

Phideria has proven competence in conducting project feasibility studies as well as environmental impact assessment, project appraisals, design and water supply and technical drawings. She has received numerous scholarships and awards, including the Dr David Livingstone Award (at the Polytechnic) and the German Academic Exchange Service (DAAD) for her master's degree. She has also received several academic fellowships.

the mould, ignoring these perceptions and supporting my decision to become an engineer.

This doesn't mean I do not spend time in the kitchen now! I am also happily married to David and we have a handsome son, Terence. My family is just as much a priority as my career.

What do you like to cook?

Oh, wow, place a plate of potato fries with salad in front of me and I'll be okay with it. If I had to choose, my favourite thing to cook and eat is traditional Malawian kilombero rice and beans.

Could you elaborate on your educational background? What led you to become so successful in what you do?

My educational journey began in October 1984 at Lipunga Primary School in Mchinji, after which I went to Likuni Girls Secondary School. I'm proud to say that I was the best 1996 MSCE (O-level) student at the school. I was then selected to do engineering at the University of Malawi, the Polytechnic, where I graduated with a BSc in civil engineering.

After working in the civil service for some years, I decided in 2007 to further my studies in Germany at the University of Lüneburg. All the courses were presented in German, except technical English, which was a huge challenge. However, I managed to keep up and successfully graduated with an MSc in water resources management in 2009.

Over and above this, I've completed numerous courses in areas of water resources development and management, water supply and sanitation, irrigation development and management, environmental impact assessment,

as well as project management and appraisal. My happy place is with my nose in a book, studying the subjects I love.

You've received several awards and recognition during your studies. Can you tell us more about these achievements?

I'm not usually one to boast, but since you ask, throughout my studies and career, I have received numerous scholarships and awards. At the Polytechnic, on more than one occasion, I was one of the recipients of the Dr David Livingstone Award, which is given to students who excel. I was extremely honoured to receive the German Academic Exchange Service (DAAD) scholarship, which sponsored my master's degree in Germany. I was also the proud recipient of the Australian Award Scholarship for a short course in Australia. One of several fellowships I was awarded, and the one I am most proud of, is the Kumvana fellowship, which facilitated my leadership training in Canada by Engineers without Borders. During this training, I got inspiration from some of the first female engineers in Canada whom I was privileged to meet.

Let's move from your studies to your career. Tell us about where you started and what your current position entails.

Sure! I briefly worked for a private construction firm after college, just before I joined the civil service in September 2002 as an irrigation officer in their engineering department. Over the years, I have risen through the ranks. I worked as the regional irrigation and water development officer in Malawi's southern region, where my main duty was to lead and coordinate the formulation of the region's contribution to national irrigation and

water development activities.

The goal was to do this in line with government policy, through development and management of water resources for sustainable, effective and efficient provision of potable water, sanitation and irrigation systems. I provided support to the ministry's interdepartmental and district teams in the development of water and irrigation infrastructure, as well technical guidance and advisory support services.

Thereafter, I became the deputy director of irrigation, responsible for planning, design and construction of irrigation infrastructure. My duties included overseeing the engineering activities of the department, managing the planning, design and construction sections in line with departmental policies, strategies and performance. I had to ensure that all technical engineering-related issues connected with the smooth implementation of the department were promptly addressed. I had to oversee the preparation of irrigation development project proposals for funding by development partners and government; ensuring that best design and construction practices were followed in irrigation development. I also had to ensure that environmental consideration was applied for all irrigation and drainage projects.

I am currently working as deputy director of the Department of Water Supply and Sanitation. It's an incredibly rewarding position, especially when you see the smiling faces of people getting potable water for the first time. I am involved in so many important facets of Malawi's water sector and participate in developing a number of national master plans,

including the National Water Policy, the Water Resources Master Plan, the National Earth Dams Design and Development guidelines, and the Water Supply and Sanitation Investment Framework. I really love what I do and the people I work with.

What is your most memorable or challenging professional experience?

There are several memorable moments in my professional life. However, I will single out one, which is when I was doing my master's degree in Germany. This was one of the most challenging moments, as all the lectures were in German. Considering that it was a language I had never heard or read before, coupled with the course being extremely technical, it was fairly daring of me to embark on this journey at all. However, as the saying goes, where there's a will there's a way. With the three-month language course in the basics before I started the master's programme, I managed and got my MSc in water resources management.

From that point onwards, my belief is that nothing is impossible on this earth. You can achieve anything you put your mind to, always believing in yourself and your capabilities.

As a leader of water-related issues and also a woman in engineering, what is your approach to solving water, sanitation and hygiene issues in Malawi?

A good question, which I relate to on many levels. Women and girls spend a significant amount of time walking long distances to fetch the water needed for their households. This time spent every day means they

miss out on important opportunities, such as education, time for enjoying childhood activities and socialising as they get older.

We should really focus on issues that will reduce the time women spend and the distances they walk to fetch potable water. It will take time and effort to achieve this, but I believe it's possible. I implore the people of Malawi in particular, and the entire African continent, to use the available water conservatively and to stop polluting the scarce fresh water sources, so that we're able realise the full benefits of water and sanitation services.

It is rare for women to lead challenging sectors like irrigation, water, sanitation and hygiene in the African context. What is the secret for your successful journey and what advice can you offer?

Allow me to quote Winston Churchill when I answer this: "Success is not final and failure is not fatal: it is the courage to continue that counts." And Michael Jordan once said, "If you quit once it becomes a habit, so never quit."

Every human being is unique in their own way and we must realise our strengths and embrace our uniqueness – these things will shape our success!

I believe fear is one of the biggest barriers to success and reaching any goals you set for yourself. As a leader, I strive to be a good follower, as leading and following are synonymous. I also make sure that I understand my role, obey the rules and regulations, and know that as a leader, I am there to serve. I am constantly learning and embracing every challenge that comes my way – as behind every challenge lies a new opportunity.

Professionalism has no gender and I avoid acts of pity. As an engineer,

I do work that entails visiting water supply intakes that are mostly in areas that hard to reach. We sometimes need to rough it and camp in the bush. I do not believe I would have achieved all that I have if it weren't for my loving and supporting husband.

Where would you want to see women, including yourself, in the next five years professionally and in leadership, in engineering in general and in the Malawian water sector?

We all know that water is life and every domestic, biological (and many industrial) activities revolve around it, using it in some way or other. It is also a fact that in Malawi and most parts of the world, women and girls bear the burden of fetching water for domestic water supply and sanitation, as well as maintaining a hygienic home environment. As managers at the household level, women have the highest stake in the improvement and management of water and sanitation services, not forgetting sustaining the facilities. Therefore, it calls for women's participation, involvement as well as taking leading roles in water-related development efforts.

Tell us what you enjoy doing apart from your work?

I really enjoy sewing! I find joy in making outfits for myself, family and friends. Sometimes people ask me where I bought my dress and then I love responding that I made it myself. I also do a bit of gardening and consider myself a small-scale hobby farmer, with the emphasis on indigenous crops. Whenever I have the time, I make an effort to pour energy into mentoring young girls, mainly in rural areas, to be self-reliant and to believe in themselves, set goals, stay focused and pursue their dreams. It's

very rewarding and I'd like to continue doing it as long as I can.

Any final thoughts to share with us?

When work and passion are in harmony, everything falls into place. Follow your passion, channel it and make it work for you. It does not even need to be how you earn a living, but it needs to be part of your life in some way. It is only by acknowledging and developing our innate gifts that we find true contentment.

JOURNEY 19

**NOT AN EASY RUN,
BUT WORTH THE RIDE**

Christelle Sieyadji

Senior Talent Developer at TotalEnergies

CONGO

We'd like to start by hearing about what you love most about your job. What inspires you most in what you do?

Oh wow, so many things! My work is so diverse and extremely rewarding in so many different ways. I love the challenges and satisfaction that come with solving difficult problems. I get to constantly learn and develop new skills, and help grow the company I work for. I get to meet, interact and work with exceptional people from all over the world, work in incredible teams and travel to fantastic places.

I've had the privilege of travelling to so many amazing locations – rainforests, deserts, beautiful cities, amazing hotels. I've seen wild elephants in the rainforests of Gabon, sand winds and majestic dunes in the deserts of Algeria, snowflakes falling in the United Kingdom. I've been on Table

ABOUT THE AUTHOR



Christelle Sieyadji has a degree in maths and physics and an engineering degree from the Interstates School for Hydraulic and Rural Equipment Engineers in Ouagadougou in Burkina Faso. She also holds a master's in management for the oil and gas industry (MOGI) from Heriot-Watt University in Edinburgh, Scotland.

After 18 months of working in a small family company involved in development projects in Burkina Faso, Christelle embarked on a borderless career in the oil and gas industry. In May 2002, she joined Schlumberger as a cementing field engineer trainee in Algeria. After 10 months of successful training, she worked in Congo and Gabon, after which she became a services manager, managing field staff, equipment and products for cementing, stimulation and coiled tubing operations in both Equatorial Guinea and Cameroon.

In 2010, she recruited university students to work for Schlumberger and further supported the organisation by working in HR staffing and planning management. Christelle later became their sales manager, where she was responsible for maximising sales, coordinating tenders' submissions and establishing professional relationships with key customers.

In May 2015, she became the HR manager in charge of the overall management of HR services and programmes for Congo and Gabon. Two years later, she was promoted to HR manager for the entire sub-Saharan Africa. Christelle then decided to move back to operations and in July 2018 she was promoted to operations manager in charge of well cementing, well stimulation, coiled tubing services and products delivery to customers in central Africa.

In June 2020, Christelle joined TotalEnergies as a senior talent developer. Her main responsibility is to develop her clients' capacities throughout their career path. Christelle believes that growth, personal development and engagement are keys to personal fulfilment. Her credo is developing borderless career paths so as to balance one's work and personal life.

Mountain in South Africa, I've experienced where the Indian and Atlantic Oceans meet. It's all been so special, and I feel so excited for what is to come!

Where were you born and raised?

I was born in Pointe Noire, the second-largest city in the Congo. At the age of one, I moved with my parents to Brazzaville, where I grew up and attended school up until my first year of university.

What profession did your parents have? Were they supportive of your higher education?

My father was a customs officer and a total bibliophile. He loved reading whatever he could get his hands on – newspapers, magazines, books, and on a wide array of topics. Growing up, my siblings and I were always in awe of his immense knowledge. Unfortunately, when I was 14, he passed away, but I know he would have been supportive of my academic pursuits. His passion for learning and development has left a lasting legacy that still helps drive me to this day.

My mother was a nurse and she was very supportive of my higher education. She had wanted to study medicine but hadn't had the financial means, so she did whatever she could to give her children that opportunity. She spent several years not buying herself any new clothes or jewellery so that she could put all the money she had towards our basic needs and education. The sacrifice she made on our behalf means the world to me.

What life advice did you get from your parents?

They told me that life is a succession of challenges and that it would be unwise to count on an easy run. The best thing you can do is work

hard, work efficiently and strive for excellence in everything you do. And that is indeed how things have been for me. Life is full of highs and lows, ups and downs. I remember after I had my second child, I thought I really needed to stop doing fieldwork (I work in the oil and gas industry) because I needed to spend more time at home. It was gratifying that my needs were accommodated, because my company really valued me. It was a great validation for me.

What games did you enjoy as a child?

I was definitely an extrovert and loved playing outside with lots of friends. I enjoyed active games like hopscotch, rope jumping and duck-duck-goose, as well as board games, puzzles and cards. I also loved building sandcastles, playing with blocks and fabricating toys out of basic materials we could find, like cardboard, tins and clay.

Did your parents differentiate between you and your siblings growing up?

I am the eldest of six children, two boys and four girls. Other than some differences in the toys we got (cars for boys and dolls for girls), we were treated the same. We were given the same number of chores and were pushed equally to do well in school.

Can you remember the first time you became aware of engineering as a career choice? Were you interested in going into the field growing up?

I first became aware of it in high school when looking at the subjects I could take at an advanced level. I was immediately drawn to engineering

because it was about problem solving and finding solutions to technical problems that would also benefit my community, but at the time I thought it would serve my community better to become a doctor. It would enable me to work at a hospital and take care of people, as my mother was doing.

I didn't end up getting into medical school but was accepted into the engineering programme during the second year of my maths and physics BSc degree course. My mother had no objections to my studying engineering and I would still be able to support my community as an engineer, which was important to me.

What was the ratio of men and women at university? How did your classmates and lecturers treat you?

We were 240 men to 10 women at university, and 30 men to three women in the Engineering Department. There were a few ignorant comments from classmates who felt that the other women and I weren't in the right place, but overall, my classmates were great and my lecturers were supportive. I never felt objectified as a woman on campus and found it very female-friendly.

Did you ever feel you had to prove yourself to your classmates or lecturers?

I didn't ever feel I had to prove myself because my ability to work well with others and my good results spoke for themselves – I was in the top five in my class.

After you graduated, was it difficult for you to find a job in your chosen field?

In my case, things went quite smoothly. I graduated from engineering as one of the top three students, which meant I was awarded a one-year scholarship for integration into a job.

All I had to do was find a company that would appoint me; the scholarship covered my salary, like a paid internship. After one year of integration, I got my first full-paying job. It was a small family company involved in development projects, but it wasn't really challenging enough for me, so I soon decided to look for a position at a bigger company.

Unfortunately, at the time most big companies related to my field weren't appointing candidates with little field experience, but then I remembered from when I was still looking for work as a student that the Schlumberger company was willing to appoint new graduates of all nationalities and engineering disciplines and train them up based on the job offered.

My experience at that time was in hydraulic and rural infrastructure engineering, and I was amazed to hear that Schlumberger was willing to appoint me even though the position they offered was in the oil and gas industry. Although it wasn't my field of expertise, there were many overlapping elements in what I had studied, so I knew with the training I could learn to meet the position's requirements. The most important thing that the job offered me was what I wanted to do most: to provide essential services to people living in remote locations, provide solutions for clients, and to enable me to work with men and women from all over the world.

Did you feel accepted and respected at Schlumberger as a female engineer?

Absolutely. Gender diversity has always been a priority for them and I felt deeply respected there. They aspired to have a diverse workforce from different cultures, backgrounds and nationalities, working together towards common objectives. This is where the company's strengths lay and it helped them maintain a competitive edge.

Did you ever make any modifications to survive in a male-dominated industry?

The only real modification I made was changing the timing on when to have children. I had originally planned to have my first child as a student and the second one once I got employment, but due to the fast-paced and demanding nature of the work, I ended up waiting six years before having my first child.

How did you and your husband meet?

I met my husband at engineering school and, being an engineer himself, he understood how demanding this profession could be. He encourages and supports me in everything I do. This is a blessing. I think a lot of men who have small egos struggle with having a successful partner, especially one who works in a traditionally male-dominated industry, but my partner just gets it and appreciates how good I am at what I do.

What has it been like to juggle a demanding career and a family life? Have you been able to find a balance?

Balancing work and family life has definitely had its challenges. Sometimes I find myself in situations where my job and family both need me, and I have to make difficult choices. It's been really tough because

over the years I've had to miss a lot of birthdays and school activities while away on business trips.

Even when I was around, I had to work late, which also meant that I wasn't able to kiss my children goodnight, and that was very hard. The key to finding the balance for me was getting help. I have domestic workers and nannies who help cook and take care of the children, and both my mother and mother-in-law help where they can to take care of the kids.

In the end, I know my job is providing a good life for my family, with opportunities for good education and future development, and I have also arranged my job to give me more time with my children. My family has always come first, and always will.

It seems as if more and more women are entering the STEM field than ever before. Do you think things have improved for the present generation?

We still have a long way to go, but things are definitely improving. Many companies, like the ones I have worked for and where I work now, are making diversity a priority in the workplace, and realise it actually gives them a competitive edge. Through good performance and working well with others, women in engineering will be rewarded with success and opportunities.

In what way do you work towards helping redress the gender disparities in the sector?

At Schlumberger, I spent some time in recruitment and visited numerous universities to encourage young women to enter the engineering field. The

company has a mandate for a minimum of 30% female representation. So that's a start!

I recently made a move to join TotalEnergies as a senior talent developer after over 18 years with Schlumberger. I focus on human asset and talent development and have been dedicated to carving out a borderless career in the oil and gas industry for myself.

At the same time, I have a family, I have hobbies and have found the middle ground to achieving balance and contentment, both in my personal and professional life. I hope I can stand as an example to others of what is possible. It takes incredibly hard work to constantly learn and grow and keep yourself and others feeling secure and happy, but it can be done. The limits of what is possible can be extended and personal fulfilment and satisfaction can be achieved. I am proof of this, for sure. You just have to work for it.

JOURNEY 20

FROM FLYING BULLETS TO IGNITING SPARKS

Catherine Wandera

*Dean of the Faculty of Engineering and
Senior Lecturer, Kyambogo University*

UGANDA

Catherine, you're currently a senior lecturer in the Department of Mechanical and Production Engineering at Kyambogo University in Kampala. Teaching students during a pandemic cannot be easy. How do you deal with stress in general?

I love to spend time in my kitchen, cooking and baking. That's the way I unwind and deal with an overly busy mind. I am quite passionate about preparing food. During the height of the lockdown, I started baking a lot; red velvet cakes, marble cakes, you name it. People were surprised that I can bake, but it's a natural gift and of great interest to me. The only problem is that it also means I tend to eat too much cake, and then I struggle to maintain my weight! I think many of us are dealing with confinement

challenges, and indulging in food is one of them.

If you weren't a mechanical engineer, what other path do you think life might have taken you on?

Well, I absolutely love to dance, but I never considered doing it professionally. I am one of those people who can dance anytime and anywhere if the music is right! I enjoy tunes and lyrics that speak to my heart and soul. I listen to a variety of Ugandan musicians and I love gospel music. When I did my PhD in Finland, I joined a church choir that was composed mostly of older, middle-aged Finns. My supervisor had suggested I audition when

ABOUT THE AUTHOR



Dr Catherine Wandera holds a PhD in mechanical engineering from the Lappeenranta University of Technology in Finland. She is currently working as a senior lecturer at Kyambogo University in Uganda and is dean of the Faculty of Engineering.

Her research interests include a focus on improving manufacturing processes and industrial systems for enhanced quality, productivity and energy efficiency. Most of her research accomplishments are in the area of laser materials processing. She has published papers in reputable journals and international scientific conferences in the manufacturing engineering discipline. She aspires to become a professor and is working towards attaining that goal.

Catherine has mentored a number of her junior colleagues to advance their academic careers and develop their employability. She supports the activities of Uganda's Life Ministry, which mentors teenagers from a Christian perspective. She enjoys cooking, baking, listening to music, singing and dancing in her moments of relaxation. Above all, Catherine cherishes the virtue of working for the common good in line with the scripture about treating others the way you want them to treat you.

he heard me hum a tune and I got in! I was so surprised and delighted. At the time, I was still learning Finnish and I didn't understand all the lyrics we sang, but just loved the sound of the voices together.

We used to visit old-age homes and sing to the residents. There was a 99-year-old man at one place; you could see how he loved it and he told us that he had also been a singer. The group was a great way for me to feel more connected and integrated in Finnish society. They were warm-hearted people and it helped with homesickness. When I defended my PhD dissertation, the whole choir ensemble came to listen to me. It was really special to have their love and support that day.

Can you tell us about your early years? Where are you from and where did you grow up?

I was raised by my mother, Agudo Laura Margaret, in a small town called Soroti in the eastern part of Uganda. My mother worked as a midwife at Soroti Referral Hospital in the eastern district of Soroti. My biological father was an aeronautical engineer and lived in Entebbe, close to the capital, Kampala. My stepfather, Enyamu Henry, the father of my three younger siblings, worked in the nearby town of Mbale and visited us often. He treated me like his own and played the role of father to me as I was growing up.

During my childhood in the 1980s and early 1990s, our town and the surrounding villages faced an insurgency from the Lakwena rebels, Teso-based rebels and Karamojong cattle raiders. There were many incidents of daytime gun fights when the government soldiers fought off the Lakwena

rebels who entered Soroti. We often had to run home to take cover by lying face down on the floor to avoid being hit by flying bullets!

What was school life like as a young girl in Soroti?

It was a scary and chaotic time – most of my primary school years were marked by children being suddenly dispersed from school when there were rebel attacks in Soroti. Teso-based rebel attacks in the villages surrounding us also resulted in many internally displaced persons (IDPs) moving to stay in Soroti, which caused a surge in the number of pupils at the day schools, including mine. To accommodate the increased number of pupils, my school had to conduct our classes under trees, so we learnt to cope and learn under dangerous circumstances. I believe this has made me a highly adaptive person.

How did your family cope financially during this time?

That period of insurgency was marked by scarcity of basic needs and my family was among those people who queued to receive food support distributed by the World Food Programme. As schoolgoing children we also had to be given scholastic materials by the government of Uganda.

My entire primary school education was financially supported by my mother, but her salary was not even sufficient for the family needs and was often paid in arrears. We experienced scarcity of all basic needs, which was characteristic of life in war-torn areas. My biological father started paying my school fees when I went to secondary school.

Did you have any kind of relationship with your biological father growing up?

I only met my father when I was 12. This was during my school holidays and I only spent one day with him on that first meeting. When I was 16, my uncle took me to my father's home in Entebbe and from then I lived with my father and his family while visiting my mother during the December holidays.

Did you show any interest in engineering during your early school years?

Growing up near the Soroti Agricultural Implements and Machinery Manufacturing Company (SAIMMCO) and seeing the fabrication work done there is where I started to develop interest in the field. I always liked to make things with my hands and one day when I was in Grade 4, I found a piece of steel sheet metal around the SAIMMCO compound that I tried to bend into shape to make a container for my pens and pencils.

When my mother found me fidgeting and fiddling to bend the steel sheet, she told me that because I had these interests in fabrication and performed well in mathematics, I could become an engineer, like my father, if I wanted to. My parents were both very supportive of my studying engineering.

Was it easy for you to share your desired career choice with your classmates?

I was in an all-girls boarding school in high school and I always openly shared my desire to study engineering with my classmates. We had about 10 students in our physics, chemistry and mathematics class and all of us wanted to do engineering at university, so it was easy to discuss our career choices without the fear of being judged.

How did your classmates treat you at university?

I had been in girls' schools in both primary and high school, so when I found myself as the only girl in the class of 27 students in the BSc agricultural engineering programme, it was a bit scary. My classmates were however kind and helpful, even though I was the only girl.

What were you like at university?

I was a studious and reserved student; definitely not a party person. I remember during the final semester at university one of my classmates overheard that I'd never been to a nightclub, so he vowed to take me out to one of the top clubs in Kampala for his brother's bachelor party. On the day of the event, I waited and fell asleep before he even picked me up – I had no idea clubbing only started late at night!

Was it difficult to find financial aid to pay for your university studies?

It was difficult to find the money for my undergraduate studies. My mother belonged to the savings group at her workplace, from where she accessed small loans which she used to pay my tuition fees in installments. My father also sent me some tuition fees support, but rather intermittently at that time. My aunt was also resourceful during my university days and let me stay in her home in Kampala.

I managed to weather the tuition fees storm during my undergraduate studies, and I was lucky to be among the 25 students in my class who graduated together in 2003. When I went abroad in 2004 to do my master's, I wasn't charged tuition fees and only had to cover my living costs, which

my father and a friend of his helped me with in my first year and also part of the second year. After that I was able to get some work from the university to help support myself.

Once you graduated, were you encouraged to get married over following a career?

No, my family accepted that my career was important to me and even encouraged my fiancé to support me to pursue postgraduate studies overseas. I completed my master's degree in mechanical engineering in Finland in 2006 and then returned to Uganda and married my fiancé, who was supportive and had waited for me while I was studying abroad.

Did you ever have to keep a low professional profile amidst men all around?

Yes, I have sometimes felt I had to keep a low profile about my education level and job so as to blend into some social settings. I feel pressure to keep quiet in certain contexts dominated by men to avoid being perceived as dominating or controlling.

Do you think women in Africa face more challenges than women in other countries?

Yes, I think women in Africa do face more challenges than women abroad, at least in most developing countries, because conservative African cultures still believe in the idea that women need to be the ones at home, raising children, sacrificing their educational or work opportunities. Women in more progressive countries can and do share the responsibility of raising children with their spouses.

An African woman may also be more limited in playing a role in financial decisions for the family than women abroad. She might feel she has to give up a professional job due to the demands of taking care of the family's children but then won't be afforded the opportunity to have a say in financial decisions for the family.

What do you see as your role and responsibility for encouraging women into the engineering and wider STEM field?

I think it's my duty to demystify the belief among girls and women that engineering is a domain for only men by showing that women too, like me, have managed to perform well in the engineering field and can handle subjects like mathematics, physics and chemistry. We have to champion women like myself who have excelled in these subjects in order to encourage girls in higher school to study these science subjects and to join STEM and specifically engineering programmes in higher education.

Has the perception of Ugandan society regarding working women changed with time?

Yes, the perception in society about working women is gradually improving as more women access education and increase in number in the workplace. That said, there is still so much more work to be done to support women to thrive in the workplace. We need to create favourable conditions for women of childbearing age to start families while staying employed. Some working women have had to leave their jobs because of limited maternity leave and felt forced to return to work too quickly.

I really try to ignite a spark in all my students, especially the women. I

want to give back to this country and my society, which has been through so much hardship. Knowledge, tech, science and innovation can serve us and improve us and our infrastructure. I am also involved in community initiatives to improve the knowledge base and infrastructure for poorer people.

What is your one big dream for women in the workplace in modern society?

We need workplace policies on career development opportunities to support women to ascend to management positions in the workplace.

Equal pay – men are still paid more than women with the same set of qualifications and experience.

Improved policies on the maternity leave period that will enable women of childbearing age to nurse their babies for a suitable time before returning to work.

Suitable laws that require workplaces to provide day care centres to support mothers with infants to thrive professionally, knowing their babies are taken care of.

Are you able to balance work and your personal life?

Yes, I try to keep to my working hours just in the week to give myself time with family and friends over the weekends. The nature of my job means there's weekend work sometimes, but I make sure to only make myself available on Saturdays and always keep my Sundays open for family

and personal time.

Can you leave us with some final words of wisdom?

A friend of mine asked me last year if in my early life I had ever thought I would become a doctoral degree holder, especially at the age of 32. With what was going on in my country and with a severe lack of funds for tuition fees across my academic life, I can confidently say I did not expect to be where I am today.

I am so thankful for my faith in God that guided me in overcoming the many challenges I faced in my academic journey and for making me the kind of person I am today. I am humbled by my own life experiences, and I recognise that we all need other people to support us to reach our goals.

There is a common saying in Uganda that you have come from far, meaning that you have transformed greatly and overcome challenges in life. I feel this has indeed been my journey.

I have deep appreciation for all the people who have supported me on my journey to success, and it's their support that encourages me to do the same for the future generation of women in my family, society and in engineering in general.

I hope the story of my educational and career journey will inspire other young people who may face similar challenges and to encourage them to keep on pushing, working hard, and never ever give up on their dreams.

MEMOIRS

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JOURNEY 21

JOYFUL JUGGLER AND SEED PLANTER

Abebech Agera Beyene
*Assistant Professor of Irrigation and
Water Resources Engineering*
ETHIOPIA

We reap what we sow: A woman born of simplicity

Abebech Beyene was born in 1984 in a rural village in the Dangila district in the Ethiopian highlands. She is the fifth born in a family of eight children, and her middle name, Abera, which means strong, powerful and noble, really turned out to define her.

Her parents were subsistence farmers, and neither were able to attend formal schooling during their childhood. The family raised chickens, grew teff for injera (an Ethiopian grain staple and major cash crop) and cultivated potatoes, maize, barley and peppers. To this day, Abebech's favourite home cooked dish remains doro wat, a chicken stew her family has prepared since her early childhood days. They slaughtered and plucked a plump chicken, washed it with lemon juice cooked it with garlic, ginger and Berbere spices

and then served it with steaming portions of injera and lentils. “Every child must learn to slaughter livestock and every child will cry the first time,” she wryly recalls those simple childhood days.

Later in life, Abebech’s parents did get the opportunity to attend adult education classes provided by the Derg regime (1974-1990), and learnt to read and write in the Amharic language. At this time, the family moved to the neighbouring Fagita Lekomma district, where she attended her first school, Finzit Elementary, and later completed Grade 8 at a junior secondary school in Addis Kidam.

The family belonged to devout members of Ethiopia’s Orthodox

ABOUT THE AUTHOR



Dr Abebech Beyene is currently assistant professor of irrigation and water resources engineering at the Bahir Dar Institute of Technology (BIT) at Bahir Dar University in Ethiopia. She teaches and advises MSc students and leads a research group at the Irrigation and Hydraulics Research Unit within the Blue Nile Water Institute at the university.

Abebech graduated with a BSc in soil and water engineering from Haramaya University in Ethiopia and obtained an MSc in irrigation engineering from Arba Minch University in Ethiopia four years later. In 2018, she received her PhD from the University of Ghent in Belgium.

Her research focuses mainly on detailed field experiments and analysis using physically based numerical models (Hydrus, RETC, SPAW), biophysical models (Aquacrop, Cropwat, WEAP) and GIS-based image analysis (ArcGIS, ERDAS, Imagine) to enhance water resources management strategies in irrigated agriculture. Her research is used by policymakers as well as researchers, as it focuses on the hot issues of water resources management in Africa and small-scale irrigation management.

Tewahedo Church, and Abebech thinks fondly back to celebrations of her favourite feast day, Epiphany, when all the little village girls would get dressed up from head to toe in white and enjoy a day of celebration, music and eating together. Her faith remains a pivotal part of her life to this day.

Sowing the seeds of success and sustainability

Abebech sees her childhood as the foundation of her success as she grew older. She felt motivated through the challenges she faced during this time as she learnt how to be practical, adaptable and contend with hardship. Throughout her journey, she always remembered her family, the community and the subtle stresses of societal integration, which she saw as farming and harvesting the seasons of her young life, onwards into adulthood.

Because she learnt from a young age how seasons operate and nature functions, she still knows how to align life with the cyclical nature of things. It is a good lesson.

Abebech also experienced many joyful childhood moments. She views the challenges of her family and the rural community as a blessing that created interesting occasions and developed her sense of resilience. She fondly recalls celebrating family holidays such as Christmas and New Year, the foundation of the True Cross and Easter. Passionate about farming, she would visit the farmlands during cultivating, planting and harvesting seasons with her family.

The fate of a girl child

The cultural norms in the rural areas of Ethiopia during her youth held that girls were of a lower value in their society than boys. Girls were

expected to do housework and support their mothers after school. According to Abebech not much has changed, sadly. These days in poorer farming communities, girls are still expected to equally participate in the farming activities alongside boys, as well as do household chores. The academic opportunities given to females are few and far between, which often forces them into early marriage.

According to Unicef 2020 statistics, “Ethiopia is home to 15 million child brides; the country has one of the world's highest rates of early marriage. Four in ten girls in Ethiopia marry before their 18th birthday; the majority of them give birth while still in adolescence. Ninety percent of these girls will never go to school, much less attend university.”

Contending with such challenges motivated Abebech to develop the strong habit of not blindly accepting, but rather asking for information and seeking opportunities to grow her innate intellectual talents. She had a drive to develop her mind and excelled academically from early on. She counts herself as extremely fortunate to have broken from the norm. Today, she is passionate about uplifting girls in her society and works hard to do so.

Leaving home: the seed of learning germinates

Recognising their daughter's academic potential, and since there was no high school in Fagita Lekomma, the family eventually sent Abebech to Dangila, 21km from Addis Kidam, to complete Grades 9 to 12. It was a challenge to live far from the family she shared such a close bond with and adjusting to her new life was tough. Abebech worked extremely hard at school and soon found herself at the top of her class. She started dreaming

about making a real contribution to her family, her community and her country, with the hope of alleviating poverty and poor levels of education.

This is when her dream to become an engineer began. After finishing Grade 12, she took the Ethiopian School Leaving Certificate Examination (ESLCE) and selected natural science as her main subject. Her hope was to start university immediately and due to her excellent results, she achieved this ambition and was accepted to study engineering.

University life: the seed is transplanted, the plant emerges

After graduation, Abebech joined the Soil and Water Engineering and Management Department at Haramiya University. Unfortunately, the university was located far from her home, and the transport infrastructure was challenging, making visiting her family difficult. The young woman was now, for the most part, on her own, in an entirely new environment. At the time, the number of female students entering universities compared to male students in Ethiopia was limited. This exacerbated her sense of loneliness, isolation and acute homesickness.

Abebech really missed her home and the people she loved. But she remained committed and steadfast, focusing on excelling in her studies during these emotionally challenging times. She was determined to achieve good results and to obtain her degree with flying colours. And she did what she set out to do, graduating with distinction.

The plant had emerged and was flourishing.

Reaping the harvest of hard work

In 2006, upon college graduation, Abebech joined the Amhara

Agricultural Research Institute as a junior researcher in the agricultural water management unit. During this time, she was able to apply all the theoretical knowledge she had gained and could carry out invaluable practical field research.

She acquired tremendous on-the-ground field experience, as well as crucial office and desk skills, which she says opened a pathway to becoming a scientist. After two years, she was given the opportunity to apply for an MSc grant and was successful. She opted to specialise in irrigation engineering at Arbamich University for her master's studies.

Full circle: the planting cycle continues – water to the people

The aspiring engineer returned to the Amhara Agricultural Research Institute after successfully completing her master's between 2008 to 2010. She worked there for another two years, gaining ground and building a solid professional relationship as a competent female researcher in the engineering field. Experts, officers and scientists in the field acknowledged her skills and attributes, and encouraged her professionally. She thrived as a result.

Through her research, Abebech soon realised that Ethiopia was lagging considerably in science and technology. She was driven to advance both field and desk research in these crucial sectors. She had a sound knowledge and understanding of the gaps in water and irrigation scheme management – irrigation being the most strategic sector for Ethiopia to focus on to overcome extreme poverty.

“Ethiopia has an extremely varied climate and topography,” explains

Abebech. “We have many water-abundant regions and others that are water-scarce. I grew up in a region with plentiful water, on the upper streams of the Blue Nile near Lake Tana. But the lowlands are extremely arid, and the trick is to create infrastructure that can store and distribute water to these areas successfully and sustainably. This is the primary focus of my work today.”

From mentor to mother in one year

Abebech decided to join Bahir Dar Institute of Technology (BiT) at Bahir Dar University (BDU) in 2012 as a lecturer. She realised that imparting knowledge was a wonderful way to empower young people in her society and help build the skills required to uplift her society as a whole. “After all, water is life,” she observes.

She enjoyed the new job immensely, lecturing BSc courses in the Irrigation Department. That same year she got married and gave birth to her son in 2013. Not letting married life or motherhood slow her down, in February 2014 she began her PhD at Ghent University in Belgium. The young mother made a tough decision to leave her son with her parents while she travelled abroad to pursue her doctoral studies.

At the same time, her husband travelled to Taiwan, where he commenced his own doctoral studies in mechanical engineering. For a time, the young family found themselves on three separate continents, but they were determined to make it work. “It was one of the most difficult things I have ever had to do and I will be eternally grateful for the love and support of my husband and parents during this critical time in my life,” Abebech

says with a sigh.

Weathering storms and fertilising the mind

Abebech's studies at Ghent University were challenging and stressful. Being so far away from her husband and newborn son was very hard on her. "I called them every single day," she says. "My son was three months old when I left and lived with my parents until he was five. It was painful for a mother's heart, but I knew that in the long term it was the right decision for our family."

As part of a sandwich programme, she could return to Ethiopia every six months to visit her loved ones. This kept the committed engineer and mother going and provided renewed inspiration to continue her studies, with a goal to advance her society. "As women, we make enormous sacrifices to juggle parenthood and careers. This has been one of my greatest lessons. It demands sacrifice and discipline and requires the support of loved ones. But it can be done!"

Even with the biannual visits to her homeland, the intense longing and homesickness affected her studies. At other times she was deeply committed and full of energy. She was doing it all, not only for herself, but for her family. Stoically contending with all the challenges in her life, Abebech was finally awarded a PhD in June 2018 with four chapters published in science-indexed (SCI) journals. It was a hugely proud moment, for herself as well as her ever-supportive family back in Ethiopia.

Laying down roots: home at last!

Returning home, PhD in hand, Abebech was able to fully enjoy life

with her son and husband. She and her husband were blessed with a second child, a baby girl, in April 2020.

Sometimes, Abebech laments that she feels herself to be a woman born for challenges. She works hard to help her country and cares tirelessly for her children, always thankful to God and nurturing her appreciation for nature.

Abebech today: creating fertile soils far and wide

Today Abebech serves as dean of the School of Research and Postgraduate Studies at BiT. She's actively involved in preparing motivational speeches, seminars, experience sharing training sessions and annual conferences. Her husband teaches mechanical engineering at BiT and they are fully supportive of one another's careers, simultaneously raising their two children.

BiT has hosted the annual international Advancement of Science and Technology (ICAST) conference since 2013. Abebech has helped coordinate ICAST both in 2019 and 2020 as a general co-chair and head of office. She maintains the standards by facilitating proposals for peer review and monitoring progress by organising progress evaluation committees of research projects. In addition, she leads a formidable team who prepare MSc and PhD study guidelines to standardise the teaching and learning process and enhance the quality of education across faculties.

In 2021, Abebech supervised 16 students for their master's studies. She teaches postgraduates, writes articles for scientific journals, helps her son

with his homework and manages the needs of her precocious toddler. She says she is the queen of multitasking and has become a skillful juggler, managing her family and professional commitments with grace. “I plant the seed of learning, and I juggle a busy home life and career!”

“I do everything quickly. I try to remain humble. I still go to the open market to buy ingredients and supplies. I carry home the bags of groceries. I cook. I play with my kids. I remain physically strong, as my parents taught me.”

Over and above her duties at the university, Abebech is fully engaged in directly serving the community through technical training and technology transfer, with an aim to update the cultivating, farming and harvesting mechanisms in Ethiopia.

She is truly making an impact on creating wealth in her community, country and the human race. Right now, her harvest is rich and plentiful because she has worked to make it so.

JOURNEY 22

VIEWING OBSTACLES AS OPPORTUNITIES

Irene Stuart Torrié de Carvalho

Dean of the Faculty of Engineering

and Researcher at Eduardo

Mondlane University

MOZAMBIQUE

Humble beginnings

Irene de Carvalho was born in Micaúne, a rural village in the central Chinde district of the Zambézia province in Mozambique in 1973. The oldest girl in a family of two sisters and two brothers, she attended school in Beira and moved to Maputo to study at university on a government scholarship. Her father was a fisherman and owned a fish drying station on Chiloane Island off the coast in the Sofala province and her mother was a homemaker.

Since the age of nine, Irene had displayed a penchant and talent for badminton. She didn't know of any other girls who could play the game. She played against boys, some older than her. This did not hinder her

confidence because she knew she had strength and determination. She went on to participate in the African Badminton Championship, something few children did, never mind females.

Referred to as the “baby of the selection”, she confidently won the Junior African Championship and became a national champion. She also played handball at school and the boys accepted her into the team. In fact, she was used to playing in traditionally male arenas, so pursuing a career in engineering was quite fitting. If engineering was as male-dominated as it traditionally has been, here was a woman who was going to change the game!

ABOUT THE AUTHOR



Irene de Carvalho has been a researcher and dean of the Faculty of Engineering at Eduardo Mondlane University (UEM) in Maputo, Mozambique, since 2019. Prior to this, from 2015 to 2019, she was the deputy dean for research and extension at UEM.

She has a PhD in food engineering from Lund University in Sweden, a master's degree in food technology and quality from Universidade Nova de Lisboa in Portugal and a chemical engineering degree from UEM. She has taught since 2011 at undergraduate and postgraduate level in the fields of food technology, food analysis, human nutrition, chemical installation project management and scientific research methodology.

Irene has authored and co-authored publications in scientific journals and is also a reviewer. She conducts research related to human nutrition and has supervised several dissertations. She has been a team member of one of the subprogrammes of the UEM-Sweden Bilateral Cooperation Programme since 2017 (until 2022). Since 2018, she has led the new strategic plan to promote the increase of women in engineering courses. She is also a member of the Order of Engineers of Mozambique.

Irene's philosophy and a love of reading

Irene's personal philosophy is "do your best and exhibit that only prejudice separates male and female skills". It was her parents who first saw little difference between girls and boys. Her mother instilled educational virtues in her children in plain terms: "[My] daughters and sons," she would say, "please study, I don't want you to become like me. I am suffering because I didn't go to school. If I went to school, I could get any job."

Fortuitously, or perhaps on her mother's instruction, Irene cultivated a habit of reading. She recounts going to a bookstore close to her home stocked with children's books. When the books arrived, the bookshop assistant kept them aside for her. Her mother also spared no expense when it came to getting Irene every book she desired. Simple yet powerful acts like these made Irene's mother her heroine and inspiration.

Her beloved mother always told her: "Study to be someone in life." Luckily, who that someone would be or what that someone would do came early in Irene's life – in Grade 9, she knew she wanted to become a chemical engineer.

Fresh bread and a strange disappearance

Irene recalls how her father, at that time, didn't accept bread from a bakery. The bread they ate at home had to be homemade by her mother. She baked every day, because her father refused to eat bread from the previous day. When the bread was left over, her mother made toast and put it in a tin to preserve it, and at the same time she baked fresh bread for the family. Besides bread, her mother also baked cakes at home and

looked after the family with much love and care.

When Irene was 11, her father disappeared. It was 1984, and there was a civil war in the country. The family believed that perhaps militia men or bandits had captured him and were holding him prisoner, or had killed him. He had gone to Chiloane Island to take care of his business there and never returned. No one claimed to have seen him. It was a mystery as to what had happened.

There she was, all of 11 years old, the eldest child, with no one to cover the monthly rent, water, electricity and telephone bills, as well as other expenses like food and clothes. “I practically assumed the home management; I was the oldest and took on the responsibility, because my mother didn’t know how to read and write,” Irene recalls.

In 2002, 18 years after he disappeared, the family discovered that their father had decided to leave them after facing financial ruin. He had been living on Chiloane for all the years of his absence, unbeknownst to them.

Irene’s younger brothers were furious and felt deeply betrayed by his actions, but she came to forgive her father. She is a stoic and generous-hearted person who understands that life is complex. “He had his reasons and life is life,” is all she can say about what happened. “I was able to put myself in his shoes and this helped me reconcile myself with his actions and with him personally.”

Irene’s father passed away from cancer a few years later.

Engineering the future

“Chemical engineering” had a special ring to it in Irene’s mind, but she

actually had no idea what it meant to be one. She had never had contact or held conversations with anyone who was an engineer. Her mother did not know what the word “engineer” meant either. Irene saw, quite rightly, that chemical engineering meant working in a large industry or laboratory, experimenting and creating new products. This was her dream. It certainly helped that she was also a good student in mathematics, chemistry and physics in high school.

The distinction between chemical engineering and pure chemistry only became clear to her during her second year at university. What exactly chemical engineering involved was therefore a process of discovery for Irene, and one she thoroughly enjoyed. It wasn't, as she'd expected, making mixtures in laboratories, but rather looking at the processes that take place in the chemical industry.

To be a chemical engineer meant conceiving a project until its implementation as a chemical installation, having knowledge of dimensions, the necessary equipment, installation and production capacities, raw materials, production and product costs. In short, it is to be a manager of an industry. And Irene felt ready for it.

Out of town

Becoming a full-time student was not easy for Irene. She had to become independent, and quickly. She travelled a whopping 1 200km to the Mozambican capital, Maputo, alone, to attend her course. She imagined herself preparing and mixing chemical solutions, natural products and making new products or improving other products, in large industries.

With little money to spare, and none for pretty dresses or new shoes, Irene felt shy to attend campus parties and focused on her studies instead. Today, she remains a homebody who prefers small family parties to big events. She believes this may be a result of these formative years.

Unsurprisingly, 90% of the students in her engineering class were male. Gender equality is not only about numbers, though, and Irene is optimistic about women's empowerment. She stresses what she had seen happen gradually in her lifetime, such as the many programmes that have been created for the development of girls and women in different societies, and how engineering can be an integral part of such societal enrichment and development.

How chemical engineers can help improve society

As any engineer worth their salt will tell you, believes Irene, great things begin by constructing solid foundations. Irene's doctorate, in fact, focused on infant feeding, since Africa in general and Mozambique in particular have staggering malnutrition rates. These rates are highest in children between younger than five. The focus of her PhD investigation was to find low-cost local agricultural crops that could be used to prepare instant infant food that is as nutritious as it is accessible.

Postgraduate life

Upon graduation, Irene's internal world changed too. She became stronger, more aware and attentive to people's opinions, attitudes and behaviour. She started to think more about the people who approached her asking for support and to ponder which of her decisions could influence

people's lives positively. She tried to encourage people to work in groups or teams and not just think about themselves, but about the collective, because as soon as the objective is reached, it affects more people and the impact on society is bigger.

Graduation, for her, was a battle won. For her mother it was a mission accomplished, a dream come true, especially when it happened for the third time. A child who came out of poverty and became a chemical engineer, earned a master's and a PhD in food engineering – what more could one say? Of course, love was also integral to Irene's development. She married her husband on 20 January 2007.

Being a qualified engineer was an interesting turn in social status, too. She claims that when she tells people that she is a chemical engineer, with a postgraduate degree in food engineering, they respect her and say things like, "It is not any woman who can do an engineering course. You are strong. Congratulations!" The fact that many people still think engineering courses are not for women is a collective mindset she is trying to change. She says you are looked at "with other eyes" when you are perceived as a skilled and educated woman.

An iron woman?

Finding a job in Mozambique was not the easiest thing for Irene, mainly due to the country having only a few industries. This started changing, gradually. Many international oil and gas enterprises were being created and there were growing developments in the food industry. Regarding the thorny issue of gender diversity in this landscape, Irene is confident that

policies regarding gender are at the forefront of expansion.

Discrimination is however a fact of life. For Irene, it's happened on various occasions, but there have been successes too. She describes how, upon returning from her doctoral studies in December 2014, the ex-dean of the Engineering Faculty invited her to become vice-dean.

As a successful administrator, Irene looked at the needs of the faculty and the challenges imposed by society. She concentrated on reconciling the academy and what the market – and country – expected from a faculty of engineering or from an engineer. From her point of view, being a woman allowed her to try and infuse a spirit of equality into the work environment, promote teamwork and, of course, increase productivity.

Starting last but finishing first

Irene's achievements are particularly remarkable if one considers the following: Because she was pregnant when she was accepted into her PhD course in Sweden in 2008, she ended up only departing in 2009 when her son was a little older.

"I started last, but I finished first! My fellow students were all older than me – I was the youngest and the mother of an infant." But she did it. "Despite all the people who thought I couldn't do it, I achieved it!" In addition, it was Irene's first time to study formally in English. This was incredible, given that her language of tuition up to that point had been Portuguese.

At present, Irene is in her second year as dean of her faculty. She claims that most of the people around her underestimated her. People say anything

from “Congratulations!”, “You are strong” or “You are doing a good job” to “We thought that you didn’t have enough power to solve many problems, but you are doing it”.

On other occasions she listens to the odd descriptive statement made in the corridors of the university, such as those who refer to her in deferential whispers as “the iron woman”.

Maintaining balance and raising an open-minded son

For Irene, there is no distinction between training, work or domestic chores. She divides her time as much as possible between doing her work and attending to her family. Whenever she talks to her son, she emphasises that he has a choice about what to do with his life.

She explains some of the options in engineering. So far, her son has selected computer engineering. Previously, he expressed interest in becoming a veterinarian, like his father. He based his decision on his love of dogs (the family has three rottweilers and one pit bull terrier at home).

Now that he is already dealing with electronic devices (such as computers and mobile phones) due to the pandemic, and has taken virtual classes, her son says that he wants to be a computer engineer. But he might change his mind. And Irene is quite comfortable with that.

Ethical vision

For Irene and her colleagues, it is an important goal to demystify that engineering courses are only for males, and spread the word that females

can and should pursue them. Her team members see themselves as examples, as leaders, who prove that they took engineering courses and today sit side by side with men doing the same jobs.

They also seek to add prestige to the role of an engineer in society – that being an engineer doesn't just mean lying under a car or changing tires, climbing poles or paving cement, but conceiving a project and all its stages of the execution, including materials and quantities.

Irene's team's collective vision is also to integrate – to bring women engineers who occupy leadership positions in public and private companies, academic professors, final-year students of engineering courses to be part of visits, trips, meetings and talks with parents and guardians of education, community leaders, secondary school teachers and the students themselves, to show that female leadership is undeniably the way forward.

But, concedes Irene, changing the environment in terms of gender has a lot to do with mindset and attitude. Men and women must begin to realise that there is no “male” or “female” profession and that there are no gender-specific courses. Men and women should be given the same opportunity. It appears simple, but changing age-old, traditional mindsets takes work.

Changing social perceptions

Social perceptions regarding working women are changing over time in traditional societies, Irene believes, but slowly. Much remains to be done. Society did not use to welcome working women, she feels, because

women who wanted to work were perceived as lacking moral principles and as not wanting to stay at home, do domestic activities and take care of their children. This is exactly the perception that needs to be changed!

She agrees that the workplace role of women is changing. Some companies are already betting on women's empowerment, but most organisations are still overwhelmingly led by men. Irene also laments that if women aspire to higher education, the prejudice that women should stay at home remains tangible. Fortunately, her husband does not subscribe to that way of thinking.

A working woman in Africa

Irene admits that African women face more challenges than their global sisters, and agrees that this is partly due to taboos, prejudices and the high poverty rate in most African countries. Many women do not have access to education and therefore do not have the opportunity to acquire complex skill sets. With a low level of education, women can't share opinions and proposals at the same level as men or find decent jobs. In short, it is difficult for women to find their place in society and to make themselves heard.

Irene has worked incredibly hard to break the mould. She is the first woman to become dean of a faculty of engineering in Mozambique, at Eduardo Mondlane University, the largest and oldest public university in the country. That has taken some doing and is a professional accolade she is deservedly proud of.

Hopes and dreams for women in STEM

Irene's dream for women in the workplace in modern society speaks to fundamental human rights. She thinks that women should be recognised, heard more and judged on their professional merit. "But we should also reconceive the notion that women should be given jobs or promotions only because they are women. Merit is key to validating women's professional roles," she argues.

Charity – or in this case change – does start at home. Irene believes that self-acceptance, both personally and professionally, is one of the most important keys to success. This is what it means to be a good professional.

Collaborating with colleagues is another important thing to consider in this context. If you collaborate, you cultivate equality. In that way, challenges become shared and opportunities abound. If you are able to discuss issues on the same level as your colleagues, you can help each other find alternatives and create more space for proposals and solutions.

She encourages all fledglings to fly in her industry, every day. When she sees a young girl, for instance, she talks about the excitement, fun and life-changing importance of school and university. And if a young girl gives her more time, she says, she tells them her story. She advises them with a simple but powerful fact: "If I am here, you can be here too."

From village girl to dean of an engineering faculty? A successful thought leader? One might think this is impossible, but Irene knows otherwise.

JOURNEY 23

FROM DAUGHTER OF THE SOIL TO TELECOMMUNICATIONS WHIZ

Caroline Jepkorir

Senior Engineer at Huawei

KENYA

Humble beginnings that teach one values

Caroline Jepkorir was born in rural Kenya, in the Nandi area in the country's North Rift region. She is from the Kalenjin tribe, which often names children for the season or time of day they are born. The “korir” part of her surname means “born at dawn”. She is also fondly known as Lelei, which is part of her family name.

Caroline's father was a teacher and farmer who later turned to full-time agriculture, while her mother was a homemaker and farmer. They instilled the value of a good education in all their children from a young age. Still, as a little girl she could never have imagined one day being a senior engineer in cloud core networking at a prominent multinational

such as Huawei Technologies.

Building a future from a young age

Caroline's parents placed a very high value on education, telling all their children, "You build your future from a young age, through education."

Her family didn't discriminate on the basis of gender – she and her brothers, sisters and cousins were all treated equally when it came to learning. She says the same applied to the rest of her community, although it's taken time for education levels in that part of Kenya to rise.

It helped that her parents didn't force either their sons or daughters to consider certain academic routes, allowing young Caroline to naturally

ABOUT THE AUTHOR



Caroline Jepkorir is a network engineer with a BSc in telecommunications and information technology from Kenyatta University in Nairobi, Kenya. She is currently pursuing her MSc in ICT management at the Jomo Kenyatta University of Agriculture and Technology in Juja, Kenya, while also preparing for her PMP certification. She has vast experience in mobile network technologies, having worked for operators and vendors in the Kenyan market and other Eastern and Southern

African regions.

She is currently focusing on using mobile data within emerging technologies to improve the world's way of communicating and transacting businesses. She is working with Huawei Technologies as a senior engineer in the cloud core network (this acts as a technical interface in the region, deploying new technologies to satisfy customer needs as they provide services and adapt to developments in the telecommunications industry). Caroline has a passion for mentoring girls in choosing career paths that align with this evolving industry, specifically to join STEM to redress gender imbalance in the field.

develop an interest in and passion for science. She recalls how, coming from a mostly male family, she'd compete with the boys on just about everything. And though they used to always beat her at physical games and tasks, simply because they were physically stronger, she proudly managed to equal and sometimes surpass them when it came to academic achievements. There was never any doubt in her mind that she'd continue her studies after school. In fact, her dream had always been to enter the field of medicine.

Goodbye Dr Jepkorir? Reconfiguring the future

Unfortunately, Caroline hit her first major hurdle in pursuit of a dream career upon graduating high school. Though she'd done well in her final exams, she missed the qualification to enter into medical school by a fraction. It was a devastating blow.

Suddenly she found herself at a loss. Where once there was the promise of a bright future in medicine, there was now a gaping void of uncertainty. She had never even considered an alternative career path. It was always medicine, dreaming even as a little girl of one day becoming Dr Jepkorir, medical doctor. Her grades were good enough to explore various other avenues, but she had no idea which path to take.

It was the family that saved the day when one of her older brothers, having also been brought up to treat women as equals, suggested telecommunications. She didn't even know what it was at the time but, her interest piqued, she explored further and discovered that it was a field that held many possibilities. On the practical side, it would also provide steady job prospects – an important consideration in the economically

challenged country of her birth.

So, instead of medicine, Caroline enrolled for a BSc degree in telecommunications and IT at Kenyatta University in Nairobi. The young girl from the farm was about to explore the big wide world of city life.

A whole new world

As a first-year student, Caroline discovered she was one of only five female students in a class of 39. This disparity in numbers would set the tone for the rest of her career. But contrary to popular opinion, she didn't experience any gender bias toward her or other female classmates.

Lecturers and students alike went out of their way to ensure that everyone stayed up to speed with what they were learning. "The lecturers even prepared us for what life would be like outside, in the industry," she says. Furthermore, not one of her fellow female students dropped out, and they all ended up graduating with a BSc in telecommunications and IT, a testimony to both their skills and the academic support and encouragement they received.

In terms of her engineering career, she did her placement at an internet service provider (ISP), followed by an internship in the same field. And when the mobile network industry – one of Africa's fastest-growing industries – came knocking, she eagerly accepted. Caroline's default career was about to become her true dream career.

A (mostly) man's world

After quite effortlessly sailing through university and her internship, Caroline started working for a mobile network operator as a trainee. Though

she found herself the only woman in a team of men, she recalls feeling on equal footing with male colleagues. Once her teammates discovered her capabilities, they freely gave her more opportunities to practise her skills – something that boosted her confidence, she says. She'd also been prepared for the male-dominated working world by her upbringing (her immediate family is mostly composed of men) as well as through her studies, where everyone had been fair and accommodating to students irrespective of gender.

She remembers finding her time as a network operator trainee tough but satisfying. “It taught me that women can do as much as, and even more, than men. Recognising them on merit rather than gender will keep women wanting to do and learn more,” she says. Despite this positive experience, she would soon discover that gender bias does indeed exist and that it can be insidiously subtle. The change came when she migrated from working for an ISP, which she only did for a short time, to being employed by a vendor in the mobile network industry.

Challenge accepted!

There's a saying that a woman is like a tea bag: her true strength is revealed when she's put in hot water. Caroline discovered the truth of this adage when she started working for the multinational Huawei Technologies. When she worked as an engineer for a vendor, the pressure was already on, she says, but now she also had to learn to meet international standards.

Caroline admits feeling intimidated by some of the people she first met in her time with the company. After her stint as a junior engineer –

handling just one product and practising just one skill, working with just one team – at Huawei she suddenly found herself working for a regional office. The heat was on, as she had to learn multiple skills in a short space of time and work across teams, delivering products and services to a multitude of clients all over Southern Africa. The job also required her to travel to the EU, which can be daunting for someone who up to that point had never left her home country.

She recalls how, for the first time in her life, she was met with suspicion whenever she was introduced to a client or a new team. “Their eyes practically shouted, ‘Are you sure this engineer will be able to deliver?’” she recalls. She got used to the feeling though and started ignoring it. But in her first months working for Huawei her eyes opened to a world she’d been sheltered from until then.

She heard tales from other women about their experiences in the field, about the biases that still exist worldwide, though more silently now than in previous decades. But rather than surrender to her disillusion, she buckled down and focused on the job at hand. And it paid off.

She recalls the project that was to become a defining moment in her career: she was working on a client project when she became friends with another engineer on the team. A month into the job – delivering and installing a project at a customer site – she learnt that unbeknownst to her, she’d been on trial the whole time. The customer had apparently been extremely wary of having a female engineer in charge and had asked for all kinds of references and proof of experience beforehand. Even with these in

hand, they were unsure. But after that first month, Caroline's friend reported that she'd far surpassed their expectations. She did so well, in fact, that the customer wouldn't let her go and she finished two more projects for them.

"This is a time and era where women have ventured into fields that have always been reserved for men," she says, looking back on that experience. "Some men are yet to accept women have caught up with them, or even surpassed them."

A new dawn: Caroline's current work

As a mobile core network engineer, Caroline integrates new solutions and supports ongoing and already live solutions on mobile customer networks. The main work is on projects that facilitate language communication by voice calls and texting – not on the mobile end-user devices, but rather on service provider platforms located on the data centres and interconnected by other means of transport like fibre networks.

The network engineer facilitates the deployment of data solutions that support internet browsing, emailing, voice over internet (VoIP), WhatsApp and Messenger. In the industry they are referred to as over the top (OTP) technologies and interconnecting devices such as SmartHomes, SmartFarming and SmartTracking, and many other solutions that use data or internet access to communicate and offer services to end users.

Caroline loves what she does. Her other passion is cooking, which is also a way to destress at home. Since working from home because of the pandemic, Caroline has explored developing her culinary skills. She believes that one day, upon retiring from the telecommunications sector, she may

even explore a career in cooking or catering.

The way forward

Caroline is eternally optimistic about the future of women in engineering and technology, and even more so when it comes to Africa. Her whole life, she'd always had the impression that the gender gap was smaller in European countries. That's why she was shocked when she showed up at a project meeting in Vienna, Austria, to find she was the only woman in the Huawei team. She's often also the only woman in client meetings, where there are usually around 20 people present. "This means women need to hear more female success stories in the field of STEM," she says.

That's why, although she enjoys meeting young engineers that join the company, she particularly focuses on the junior women. The problem isn't in the company, she's quick to point out. "I appreciate the Huawei environment because they never treat women engineers differently. The pressure and expectations are the same for all engineers, regardless of gender."

Caroline believes the problem is rooted in secondary and tertiary education and the fact that most young women still feel STEM is men-only territory, and little is being done to attract females to this field of education. "They need to hear more female success stories in STEM," she says. "Women just need encouragement that the field is welcoming and supportive, despite gender."

With this in mind – and apart from mentoring young female engineers at her company – Caroline also provides guidance to girls from her home community and other youngsters who've been referred to her by

acquaintances. “I guide them in career choices and listen to the challenges they experience in their college career,” she explains.

The CEO of a small local company recently sent one of his junior female engineers to her for mentoring. Rather than paying attention to technical skill – which the engineer already had – Caroline realised the young woman was holding back because she was intimidated by the competitive, male-dominated atmosphere in her department. Caroline was able to encourage and mentor her to believe in herself more and her right to speak openly and act with confidence in front of male peers.

Ultimately, her goal is to bring change and encourage more women to take on STEM and build on it. It’s mentorship such as this that will, despite the many gender-specific challenges, draw more women into the field – and keep them there. While Kenyan society has definitely begun to close the gender gap, there is always work left to be done. As always, Caroline remains up for the challenge.

JOURNEY 24

IT'S NEVER TOO EARLY (OR TOO LATE)

Bongekile Matsenjwa

*Integrated Lean Six Sigma (IL6S) Engineer
for Mondelez International in Matsapha
ESWATINI*

Great expectations

Bongekile Matsenjwa was born in Manzini, Eswatini (formerly Swaziland) – her parents' firstborn. This meant that she'd always felt it was expected of her, as a good daughter and sister, to set a good example to her younger siblings and to guide them. She recalls how this instilled self-awareness from a young age, as she felt she was always being watched. She learnt to be diligent in everything she took on, and did her best to avoid costly mistakes. The responsibility of being the eldest taught her discipline, focus and how to manage her life to achieve her goals.

She'd been groomed to lead and manage from a young age. As much

as this may sound like unfair pressure, she's grateful that she was shaped in this way, as it gave her the opportunity to break the many stereotypes about women and leadership.

Today she is a qualified chemical engineer and works as an integrated lean six sigma (IL6S) engineer for Mondelez International in her home country. She is also a UN goodwill ambassador and a director of the NPO WomEng (Women in Engineering) Eswatini. She was selected for a 2021 Mandela Washington Young African Leader fellowship, one of over 100

ABOUT THE AUTHOR



Bongekile Matsenjwa believes that the STEM disciplines are necessary for innovation and economic growth. After completing both her undergraduate and honours degrees in chemical engineering at the University of Pretoria in South Africa, she continued to attain a master's in engineering management. She is currently pursuing her PhD in engineering management at the University of Cape Town in South Africa.

For the past five years, Bongekile has worked as an integrated lean six sigma (IL6S) engineer for Mondelez International in Matsapha in Eswatini. As a servant leader, she believes the development of women and girls is crucial for the wider development of any nation. Bongekile is a managing director for WomEng (Women in Engineering) Eswatini, a registered NPO (non-profit organisation) that works to raise the next generation of female STEM professionals in Eswatini. As an official UN goodwill ambassador and through WomEng, she has reached out to over 1 000 high school girls to educate them on various opportunities in STEM and has empowered more than 100 female STEM professionals.

Bongekile is a registered professional chemical engineer with the Registration of Architects, Engineers, Surveyors & Allied Professionals Council (AESAP).

candidates chosen from across the African continent. On top of that she is currently completing her PhD at the University of Cape Town.

Not bad for a young woman of only 30, from one of Africa's smallest nations!

A foreign concept and standing up to pressure

Bongekile recalls never knowing of any female engineers when she was growing up, so choosing engineering as a career never occurred to her. In her community, there were lots of female doctors, nurses, teachers, police officers, government employees, accountants and even soldiers. These jobs were in demand when she was young. Unsurprisingly, her parents and high school teachers encouraged her to study medicine, which was considered a 'prestigious' career. Her parents knew that studying medicine would almost automatically guarantee a scholarship, as well as job security after graduation. As they saw it, a career as a doctor was the perfect option for her.

But Bongekile felt differently. She felt it would frustrate her and that she wouldn't find fulfilment in it. She also didn't want to put lives at risk. She knew she wouldn't survive as a doctor, as it wasn't her passion. Though at that point Bongekile hadn't chosen a career path, she knew one thing: it wouldn't be in medicine. Her parents were disappointed when she told them, but remained open-minded and listened to her reasoning. They saw sense in what she said and agreed to let her choose her own path.

What exactly would her choice be? Bongekile didn't yet know, so she started exploring her options. When she got to Grade 11, she started investigating careers in science, chemistry, physics and biology. She also did

a fair bit of reading about the kind of job opportunities these disciplines would provide and the responsibilities attached to each.

A lightbulb moment

To this day, Bongekile believes that engineering chose her. She'd always enjoyed solving complex problems, really enjoyed mathematics and found science intriguing. She describes her young self as a real nerd and says she much preferred doing lab experiments to listening to a teacher explain theoretical subjects.

At school, she was a member of the science club and attended almost every science fair, even making it to national competitions several times. She knew she wanted a career that involved maths and science; she just didn't know that it would be engineering. It was suggested to her by the supervisor on one of her science projects, and she became inspired by the idea. After looking into it, she knew that she'd found her calling. The lightbulb flashed on and it's still burning brightly!

Nothing worthwhile comes easy

As with most worthwhile things in life, deciding to become an engineer and putting in the work are two very different things. Bongekile recalls the beginning of her journey to finally becoming an engineer as being fraught with hurdles and challenges.

She remembers her chemical engineering undergraduate course having its fair share of challenges. She did her degree at the University of Pretoria in South Africa, which has an excellent ranking in the engineering field. She's grateful for the opportunity and says it was a privilege to be admitted

here. It also meant that she was under pressure to perform.

Being an engineering student meant that most of her free time was taken up by her studies. There were many modules to master, loads of assignments and a lot of other homework. She says lecturers provided only essential information in class, which meant students had to do their research and come to class prepared. They wrote weekly tests and had to tackle a lot of group projects. Bongekile credits her passion for becoming an engineer with keeping her going during those tough early days.

A good support system of friends and family helped to keep her focused. “Although the academic journey was hard, it was worth it,” she says, adding that this is why she encourages young people to consider a career in engineering. Determination and focus are essential in achieving one’s goals, she says, but they are indeed attainable. “One thing university taught me was that nothing worthwhile comes easy. There’ll be challenges but if you keep working hard, you’ll achieve your goal.”

Looking back at her final undergraduate year in chemical engineering, of the 78 students in her class, 28 were female. Since they were in the minority, they banded together to support and assist each other. Because they shared the same challenges as women, they could relate more easily to each other.

Even now, Bongekile says the number of female engineers in Eswatini is far below the 36% in her class, and they remain a tight network who support and encourage one another. Today’s female engineers are the role models to inspire the next generation, and it’s the same in all the STEM

fields, she says. She believes that these female STEM professionals must collaborate to inspire, mentor and nurture the next generation.

Joining the sisterhood

Women in Engineering (WomEng) has done a lot of work in Eswatini and Bongekile says she was eager to join the organisation upon qualifying. WomEng Eswatini was established in 2017 and is a registered NPO with the sole objective of developing the next generation of women leaders in the engineering industry. Bongekile currently serves as one of the non-profit's directors.

The organisation's main tools in developing a more diverse engineering workforce are education and technology. WomEng Eswatini is part of WomEng Global and successfully runs programmes in South Africa, Kenya, Brazil and Mexico. It's also part of a 10-year global campaign, initiated in 2017 at the UN's headquarters. The global organisation aims to reach one million girls through education and awareness initiatives regarding STEM.

In Eswatini, WomEng aims to reach 10 000 girls in the 10-year period from 2018 to 2028 through STEM education and awareness. To reach its target of 1 000 girls a year, WomEng attracts corporate investors to support young women in Eswatini. As one of the directors, Bongekile describes her role as ensuring effective and efficient operations to meet their key targets and deliver on stakeholders' expectations.

Keep learning, keep leading, keep doing

Engineering is a very technical field and therefore engineers need to be good problem solvers. Unfortunately, engineer training often doesn't

include much in the way of learning to manage people and projects. That's why Bongekile decided to complete a master's degree in engineering management. Though she'd gained good technical skills from her studies as well as her years of working in the industry, Bongekile says she realised that she lacked business and management skills. Engineering management is one programme that can assist engineers to learn how to manage human resources and facilitate projects. It's a specialised form of management that's required to successfully lead engineering or technical personnel and manage large-scale, intricate projects.

Many projects fail because they haven't been planned and organised diligently, while taking into account all stakeholders' input. This happens when the project deliverables aren't clearly specified and the schedule is unrealistic, she explains, and engineering management helps avoid such problems. Bongekile says that throughout her studies in engineering management, there was an emphasis on employability skills – those desirable qualities that apply across a variety of jobs and life situations, including team-based approaches, written and oral communication skills, management of technology, leadership and analysis and design skills. Engineering management provides both business and technical training.

What does an IL6S engineer do anyway?

In her position for Mondelez International (which produces sugar cane-based snacks and beverages) Bongekile's work primarily focuses on production line management: eliminating losses and enhancing and improving overall efficiency. "As an IL6S engineer, I support all the continuous improvement

projects of the plant, permanently seeking solutions and implementing best practices for both internal and external processes via benchmarking. I also track common KPIs like global efficiency, yield and line manning,” she explains.

She is involved with drafting and managing budgets, machine and process standardisation, and works as a packing and processes trainer. She is also responsible for establishing a team culture at the lines by providing a clear understanding of the requirements for the IL6S culture, including supporting team-building activities in cooperation with various team leaders. It is a demanding but gratifying job, she says.

Breaking down barriers

There’s no doubt that being a female engineer in a male-dominated industry comes with many challenges. Bongekile says female engineers are often viewed in terms of unfair stereotypes. According to research, women account for only 26% of those who hold computer- and maths-related jobs worldwide. Data from Unesco indicates that only 35% of women pursue a career in STEM, and of these only 3% decide to go into fields such as IT.

In Eswatini, a traditional African society with a monarchy, the number of female STEM professionals is less than 10%.

Bongekile reckons one of the stereotypes preventing girls from choosing STEM is the ingrained belief that girls aren’t suited to maths and sciences because it’s “too hard for them”. Naturally, most students – more than 60% – who struggle with maths or science in high school go on to choose careers that require few or no skills in these subjects.

The brain is a powerful tool

It's only human to want to be comfortable and avoid anything that might upset the apple cart and challenge our comfort zone, Bongekile observes. She recalls how most of her classmates in high school dreaded maths and science and that these classes were often the smallest. Students complained that maths and science were difficult. But Bongekile wouldn't let herself buy into the common belief. "The brain is a powerful tool. It controls our thoughts and ultimately our beliefs. Our thoughts shape our character and outlook in life. Our beliefs are shaped by our environment and our upbringing. What we hear and see around us determines our perspective on life," she says.

Following on from that, she says that if a person believes something like science is hard, they'll automatically experience it as hard. They'll go in with a negative attitude and won't even attempt to understand anything about it unless they're forced to do so.

Conversely, if someone has a passion for maths or science, they'll work hard and put in the extra effort to understand the topic, even if it might seem challenging at first.

The role of teachers and parents

Teachers play a vital role in shaping a young person's attitude toward a subject, Bongekile adds. They can assist students by motivating them and supporting them in their studies, and even going out of their way to ensure

that students understand mathematical or scientific concepts.

Of course, parents have a fundamental part to play in destroying the stereotypes hindering women from considering a STEM career. Unfortunately, traditional society dictates that a woman's place is in the kitchen, while males are allowed to express themselves freely outside the house.

"It's a small wonder that girls grow up 'programmed' to have soft skills and not dare to take on hard or challenging tasks in traditionalist societies. Yet from an early age, boys are groomed to work hard, be strong and provide for the home," Bongekile explains. This is why, she adds, the boy child will courageously take on any task or opportunity that'll give him the rewards he wants. Boys aren't afraid to try anything, no matter how hard or difficult, if it'll boost their ego – and that's because they were taught to behave this way.

Girls, on the other hand, tend to be timid and shy because they were always sheltered from the difficult tasks, Bongekile says. "This doesn't imply that they're not equally capable, but it's because they aren't given the platform to showcase and groom their talent. Parents and the community can, and should, change this."

Since schools provide environments that promote scientific thought and reasoning, parents can encourage girls from an early age to explore the world of science and technology. They can encourage girls to attend

extracurricular activities such as coding bootcamps, science fairs, robotics competitions, and so much more. “These activities can help stir up interest in STEM. Once teachers and parents have identified the gifts and talents girls have, they should groom them so that they become the best. Girls should be allowed to explore the world of STEM and not be hindered by stereotypes.”

Encourage aspiration through inspiration

Bongekile also believes that the gender gap in STEM is directly related to global issues of gender bias such as economic marginalisation (women lagging behind in economic opportunity and economic participation), political empowerment and participation, education quality and a lack of empowerment opportunities. It’s not up to women only to correct this, she says. “More men need to step up and open doors, both at home and in the workplace, for women to take their rightful place as partners towards a more equitable world.”

In the meantime, Bongekile continues to lead by example. “It’s never too early for something or too late for anything. If you have a dream, pursue it!”

JOURNEY 25

MOVING FORWARD, FOCUSED ON CHANGE

Linda Moseki

*Managing Director and Partner
at KM Project Management
and Consultancy Services*

BOTSWANA

Linda Moseki is a shining example of someone who uses her position of authority to drive social change. A trained civil engineer but a born mover and shaker, Linda became aware of the world she was moving through as one that requires strength, vision and dedication. Not one to turn a blind eye to social inequality. She envisions a future for black women like herself – women who possess balance and brilliance.

Early life lessons: Be open, direct, assertive and compassionate

Linda was born in the late 1960s in Gaborone, Botswana's capital. She is one of the middle children of seven siblings. Her mother was the breadwinner, but not that educated. She was, however, a hard worker and an entrepreneur who dedicated herself to her children's education. She

was a disciplinarian. She would choose the families her children would visit and not allow them to spend time where she believed there was not enough discipline in the domestic environment.

All the siblings, regardless of gender, were taught how to perform household chores. Her mother also instilled family values such as respect for the elderly. She used to inform her children that if they did not take their education seriously, they would end up cleaning their friends' homes. Linda believes that her mother's character was key in defining her outlook on life, which she describes as open, direct, assertive and compassionate. Linda also loves travelling and experiencing different cultures. What makes her happiest, however, is to change lives.

Education is a golden key

Linda was a smart student growing up, though at secondary school she

ABOUT THE AUTHOR



Linda Moseki, Pr Eng, is a Civil Engineer and Project Manager by profession and currently President of the Southern African Federation of Engineering Organisations (SAFEEO), a position she has held since June 2021. Linda has a BEng (Hons) in Civil Engineering from Kingston University in the UK and an MSc in Project Management from the University of Pretoria in South Africa. She has also been certified in arbitration by the Institute of Arbitrators of Southern Africa.

Linda is a past president of the Botswana Institution of Engineers and is also a managing director and partner at KM Project Management and Consultancy Services. She is the proud mother of two children – a son, Theo, and a daughter, Tanya.

found herself surrounded by playful boys and girls who did not dedicate much of their time to schoolwork. Despite their unruly behaviour and influence, Linda passed mathematics, science and English with flying colours. This enabled her to qualify for admission to a tertiary institution and enroll for a Diploma in Water Engineering.

She attributes the freedom to join a tertiary institution of choice, especially as a woman, to Botswana becoming independent. She regards her generation as lucky in this respect. At the polytechnic, Linda was accepted into two programmes, of which she chose water engineering. In this she followed her eldest brother's advice, because he knew how talented she was in maths and science. He also knew how well she would do if she dedicated herself to her studies. She regards this point as the beginning of her career and is grateful for her family's support and encouragement.

Ignoring rumours and standing tall

During Linda's studies, there were only three women in her class of 20. In the bigger student body of more than 500, there were only about 25 women.

Linda admits that she used to play a lot and "moved around" with the men in her class compared to the other two women. As she approached adulthood, she started taking her studies seriously and became one of the top students. Some of the men in her class expressed their jealousy by insinuating that the lecturers awarded her higher marks because she was a woman, or because she was in a relationship with male lecturers.

Linda ignored these insinuations and continued to work hard. She had

to fight off this toxicity with a strong mind and heart and focus on self-belief. She did not want to be associated with failure, so she persevered and completed her studies, obtaining a Diploma in Water Engineering.

Gender challenges as department head

After her studies, Linda was posted to a rural village to work for the Ministry of Local Government and Lands in the water department. The village was less rural compared with where her male classmates were posted. She suspected that the ministry management felt sorry for her as the only woman, and a slightly built one at that time.

A year later she was transferred to another village to head the water department. All the staff, except the secretary, were male. The department was responsible for managing rural water supply schemes at various villages including settlements that did not have water sources.

As head of the water department, Linda's responsibilities included allocating work to technical officers. Most of them refused to be led by what they called "a young girl", as traditionally most leadership positions were held by males. They expressed their distaste by taking their time in executing their duties. Linda had to find a way to deal with the situation.

Her characteristic of assertiveness and ability to be bold helped her put aside her fears and remain strong. She had to speak to her male colleagues with the highest respect (as expected culturally) to win them over and clarify their roles and responsibilities. She also had to explain why timelines were important because some employees would be out on trips for a long time so that they could claim expenses or overtime.

Linda developed a strategy of becoming closer to the employees who were cooperative. This way, she ensured better performance until the group with dissenting voices accepted change and started to take instructions accordingly. From this, she learnt that when women deal with men, they have to use a strategy such as asking them for ideas on how to handle a situation. By doing so, males would feel more respected and would relax and work cordially. She believes this to be one of her best leadership secrets.

Standing her ground: civil engineering

After two years, Linda quit her job because she felt there was no growth and the work had become monotonous. She joined the parastatal Botswana Housing Corporation, which was mandated to build houses for rent or purchase by citizens. She worked as an inspector of civil and building works for a year and was later sent to the United Kingdom to pursue a degree in civil engineering.

Linda studied at Kingston University in London. Racism was rampant and the moment she arrived, she noticed cultural differences, such as a passenger getting onto a bus or train without greeting anyone. She was one of the few female students in the engineering faculty. Most students did not want to associate with her as a black student. Coming from a developing country was also a challenge. However, she made friends with classmates from Asia and they studied well together. This helped her gain confidence. The impressive lecturers were also helpful.

After completing her degree, Linda went back to Botswana and worked as a junior engineer, undertaking designs and supervising building projects.

Back then, most contractors were old-guard men. When Linda issued site instructions for them to rectify defects and she commented on their workmanship, they would promptly inform her how they came into the world “before her”. They felt disrespected to be told that the quality of their work was unacceptable. Linda, however, stood by her instructions until they complied.

Battling pressures and facing hard truths

Linda eventually got married to her longtime boyfriend, Edward Moseki. The pair had studied together at the polytechnic and in the United Kingdom, though he was her senior. Linda’s in-laws were excited to have a daughter-in-law who was an engineer and had just finished studying abroad.

She remembers how as the years went by, both sides of her family would ask her and her husband when they would have children as per societal and cultural expectation. They ignored such comments and concentrated on their careers and other family commitments, like building their own house, until they felt they were ready to have children.

A few years after getting married, Linda changed jobs and joined a private consulting engineering firm, Ove Arup Botswana, as an engineer. Upholding high standards was paramount at the firm. She was allocated various projects to manage and was responsible for their design and supervision until completion.

Due to an unrelenting workload, she spent a lot of time at the office. This caused conflict in the family. As a married woman, one would be expected to do house chores such as cooking at specific times after work.

Because of work demands, Linda had little time for carrying out these duties. All these pressures led to her and Edward becoming estranged, and they eventually divorced.

This forced her to realise that neither company policies nor statutes paid much attention to the fact that women had different roles to play, like being a wife and a mother, and would still be expected to work as much as their male counterparts.

After successfully completing the projects she had been working on, Linda was redeployed to another project. She was promoted to the position of resident engineer in charge of the construction of Masunga Landfill in the north-east district, making her the first female engineer to become a resident engineer in the country.

The construction site was about 100km away from her home. At this stage Linda had two children and was living with the youngest, who was attending preschool at a local crèche. This forced her to commute to work daily from Francistown, where she lived.

Being far from home and going through challenging times, she decided to do something positive. She enrolled for a master's degree in project management at the University of Pretoria in South Africa. She was forced to strike a balance between her studies, work and social responsibilities, and managed to do so through dedication, focus and perseverance. She graduated a few years later despite the challenges of paying for her studies, settling her divorce and other responsibilities.

Shifting focus

Linda then made the radical move to work in the finance sector. Not wanting to sever ties with the world of engineering, she also began volunteering at the Botswana Institution of Engineers, which aims to promote the advancement and recognition of engineering in society at large. A year later, Linda was nominated as a council member and later as vice-president of the institution. In 2013, she ran for the presidency and won. The position made her the first female president of the institution in over 20 years.

Achievements such as this galvanised Linda and made her focus on specific causes close to her heart that empowered other women in the sector. She believes that governments must enforce empowerment policies such as ensuring that at least some small percentage of any government project or contract is reserved for female-owned businesses and the youth. She also expresses the need for legislation to encourage women to take up leadership roles upon graduation by introducing leadership programmes to ensure that the global quota of 30% or more is met.

Mobilised for efficiency

Women are generally good at multitasking – or so they say – and Linda is a firm believer in this theory. She reckons women make good leaders as they can make multifaceted decisions and communicate effectively. Inner strength enables females in science and engineering to manage and improve efficiency and make engineering more interesting. Engineering has therefore become far less of a “back-office career”, as it used to be perceived. This has resulted in a lot of flexibility, Linda believes, and advanced decision-making.

Linda has in the past mobilised women from diverse backgrounds to explore collaborations and ultimately start their own businesses but failed. She maintains that women need to believe in themselves and identify other women mentors in whom they can confide, so that they can express their weakness without the fear of being looked down upon by others or succumbing to the stresses of competition. Linda believes many women are also too shy to express their opinions for fear of victimisation, hence the low percentage of female entrepreneurs in the industry.

Many female engineering professionals do not participate fully in other important engineering initiatives due to family commitments that traditionally fall to women. There is a need to break this tradition, Linda says, to ensure that their male counterparts also play a bigger domestic role. This would allow females in engineering to also hold leadership positions.

Vision of hope

Linda has good project management and leadership skills and experience, including communication, negotiation and conflict resolution. She has a knack for implementing, coordinating and delivering successful, cohesive projects on time and minimal errors. Over the years, her experience and eagerness to learn reinforced her competency levels in interacting with professionals of different ages and genders.

Linda is a registered mentor with Botswana's Engineering Regulatory Body. She also offers mentoring services to other corporate bodies who

provide financial assistance to existing businesses and aspiring entrepreneurs, including the SMMEs and youth. Linda often volunteers her services to ensure that people with a passion to make a difference successfully realise their dreams. Linda is also into farming. Lack of funding is the main cause of Linda's slow progress in developing projects at the farm that would not only benefit the community, but could also be used by schools for developmental purposes. This would encourage boys and girls to choose engineering and science careers.

Linda's ultimate goal is to establish a foundation where disadvantaged children, in particular young girls, will be inspired by her work to go into engineering. We wish her well as she keeps rising!

JOURNEY 26

WINDING ROADS AND THE PURSUIT OF EXCELLENCE

Grace Mutembo

*Director - Planning and Design at
the Road Development Agency*
ZAMBIA

The story of Grace Mutembo, an enterprising and enthusiastic professional engineer, is not without its share of uphill battles. Born in Zambia into a family of 11 children, she knew she had to work hard but also play fair. Grace has learnt how to fight for what she believes in, and for what is right. Grace grew up in the mining town Chingola as the 10th of 11 brothers and sisters. She was also the youngest girl in her large family and counts her being number 10 as a privilege, as her older siblings relayed many inspiring life lessons. All her siblings possessed their own unique characters, had varied interests, dispositions and personalities. They pursued careers in different sectors, such as nursing, teaching, marketing and education. Her immediate older brother, Simon, was her closest ally

and mentor. He was always top of his class and set a fine example of how to persevere and work for what you wanted in life.

Grace's parents were also very supportive. Her mother was uneducated, but this didn't dampen her enthusiasm for her daughter's education and she was eager for Grace to achieve academic excellence. She was a calm but

ABOUT THE AUTHOR



Grace Mutembo is a civil engineer who has specialised in transportation engineering. She holds a degree from Stellenbosch University in South Africa. She is also a fellow of the Engineering Institution of Zambia and currently serves on the board of directors of the Zambian National Building Society.

Grace has spent 17 years practising engineering in the construction industry, mostly in the public sector. Her primary focus in the road sector in Zambia is planning, design, procurement, project identification, project preparation, project appraisal and the supervision of infrastructure projects.

She has interacted with numerous multilateral development banks, including the African Development Bank, the World Bank, the European Investment Bank and the European Union during the execution of projects.

During the course of her career she has helped establish the first R&D unit in the road subsector in Zambia. A notable achievement is her appointment as the first female engineer to head a technical department at the Road Development Agency (a first in the history of the Zambian road subsector).

Grace is a recipient of the 2019 Anakadzi Banking Zambian Woman of the Year Award in Construction by Stanbic Bank. Five years earlier, she received a recognition award for outstanding performance in transportation from the Zambian Chartered Institute of Logistics and Transport.

firm, sweet and grateful mother whose life was dedicated to her children's welfare.

Her father, who was an entrepreneur, fought to adequately provide for his family. His main line of business was trading second-hand clothes. During her childhood, Grace assisted her father with sales and admits that it was these precious moments at the market that helped her develop certain attributes that later became necessary for survival, both socially and academically. The most important of these was knowing how to think strategically and work with different personalities.

Grace was raised like any other girl in the neighbourhood. Her immediate older brother would sometimes sneak her into a football match with his friends just to balance the numbers between the teams. Being comfortable in a team of boys stood Grace in good stead for the bigger field she would later be playing on as engineer.

A girl is a girl is a girl, but STEM came calling

In general, however, girls were treated differently in the African home. While the boys played and did their homework, the household chores would be left to the girls. Grace was happy with this arrangement, as she saw it as preparation for building the kind of resilience and perseverance with which life eventually challenges us all. Her parents believed that young Grace was destined for greatness. They had such unyielding trust in her intellectual capacity that they were rarely surprised by her brilliant school grades.

The idea of engineering as a possible career choice was certainly a product of circumstance. Living in a mining town entailed waking up every

day to alarms used during various mining processes, seeing smoke from chimneys and dams built from mining waste. Grace saw this as a type of initial exposure to science and its applications, and found it terribly exciting.

One of her older sisters worked as a marketing manager for a construction company and often shared stories about the role of the engineers in her workplace. Grace was intrigued and entranced.

While in secondary school, her brother Simon guided Grace on the subjects she needed to concentrate on to gain admission to the university's School of Natural Sciences. She worked steadfastly through secondary school and managed to maintain her position at the top of her class. She had a natural talent and found that science subjects were not much of a challenge. A STEM career seemed to be a natural progression, given her aptitude and interest.

Some of her siblings however tried to discourage her pursuits. One of her older brothers told her that no female pupils from her secondary school had qualified for admission to the School of Natural Sciences in a decade. Grace, of course, took his discouraging words as an opportunity to demonstrate that her abilities were not determined by other people's failures or mistakes.

What you wish for is not always what you need

Grace's decision to pursue engineering was met with a strange reaction from people who had attended university before and were aware of how challenging engineering courses could be. They advised her that a field such as medicine – especially nursing – was more appropriate for a woman.

Sentiments such as these did not stymie her plans. She had grown up, after all, to believe in herself and to achieve what she desired. She saw these opinions as an opportunity to demonstrate that one can overcome the stereotypes of inferior mental capacity that are often associated with a particular gender.

Once she got to university, one thing was clear: the School of Engineering only had about 5% female attendance. Luckily, this posed no threat to daily interactions on campus. In fact, the other 95% of her classmates acknowledged the intellectual capacity of the female students and lecturers were generally fair to both male and female students.

Grace's second year at university no doubt defined her career path. At the time, there was massive advancement in the electronic industry. Almost everyone in their second year at the School of Engineering preferred the same discipline.

Unfortunately, Grace didn't make it to the top of the list, which would have opened the door to study electronics. She was, quite understandably, very disappointed. She was accepted to study civil engineering and as luck would have it this proved to be the perfect career for her. The lesson she learnt from this was that one can rise from failure and make an impact. That's if you see failure as an opportunity to forge new beginnings, opportunities and relationships.

Grace made many female friends who did social science courses. This sometimes made her question her pursuit in engineering. To her friends, Grace studying engineering meant she was a tomboy, scruffy and unladylike.

Some of her friends would openly mock her just to discourage her. Grace found herself caving to the pressure and began adjusting her schedule to avoid their judging eyes and discouraging opinions.

Despite this, she managed to find the right kind of peer support and formed close friendships with encouraging women and men alike. Her fellow engineering students helped her overcome some of the tougher moments of disillusion. Instead, the engineering crew shared experiences and inspired each other to keep moving forward.

Further comfort came from her faithful brother Simon and older sister Jennipher, who always believed in her. Sadly, Grace and her siblings had lost both their parents by the time she was in her first year at university.

A brilliant start

Grace's career took off immediately after she had completed her studies. The university made workplace experience a prerequisite to complete the degree programme, and Grace had an internship at the engineering consultancy Zulu Burrow. She got technical support in preparation for her final-year dissertation and the firm offered her employment upon graduation. The managing director, Levi Zulu, was a great motivator who treated her with respect.

Grace found it a privilege to work under the supervision of experienced engineers during her burgeoning career. Unfortunately, it was discouraging to discover that the tendency to stereotype women persisted in the workplace.

One of her male colleagues, who had joined the company at the same time as her, would be allowed to go to site without being accompanied by

a senior engineer, while she was not. The MD assigned Grace to a feeder roads programme to manage within the first six months of her employment. While this was motivating, she would always have to be accompanied by a senior engineer when visiting a site.

This turned out to be a good thing. At least, that's how Grace saw it, which is once again a testament to her optimism. She viewed it as an opportunity to learn and gain more knowledge from experienced engineers.

Thee skewed and unequal treatment, she maintains, instilled the required discipline to make sure that she had all the information at her fingertips, eventually perfecting her work output and making her feel accepted and credible as a young working professional. The work environment was generally more supportive overall, as everyone offered to help her whenever she needed it. The MD was impressed with her performance and often, and without warning, chose her to put together presentations on his behalf. This boosted her confidence.

The major challenge that most female engineers face in an industry that is perceived to be hardcore is that they must prove themselves before they are accepted as fully fledged engineers. In corporate meetings, a contribution from a woman is ignored at first and then adopted or discussed further once submitted by a male counterpart. This reaction from colleagues would seriously affect her in the first five years of her career, until she realised her achievements, rather than acceptance, are what is important.

Overcoming stereotypes

During her upward trajectory, Grace adopted a team-building approach,

but was still on a mission to overcome prevailing gender stereotypes and negative perceptions. This approach was popular and propelled her to fill positions of leadership throughout her career. Projects would be managed by a team who would be allowed to speak more openly in meetings, without male counterparts feeling intimidated. She was slowly proving her mettle, gaining the respect she deserved.

Because she continually had to prove her capabilities, she became extremely efficient and productive. The flipside was that some male counterparts and colleagues then started regarding her as a professional threat. The work environment became more challenging as she assumed new leadership positions. Because of her gender, a spectre of doubt regarding her performance abilities always loomed large. Grace had a horrible feeling that her colleagues and various stakeholders were watching her every move, just waiting for her to make mistakes. It was a high-stakes, high-pressure environment.

Seek silver linings and challenges will be overcome

In Grace's world there's always a silver lining. She found high-pressure, male-dominated environments to be a challenge that strengthened her will and encouraged her to carry on working hard, always staying true to what she loved. It remained awkward to be surrounded by people who tended to misconstrue her success and believed it was achieved due to engineering courses becoming easier. She responded to such backhanded chauvinism with characteristic politeness, integrity and, of course, grace!

Things got worse as the competition grew. Grace's tenacity and resilience

didn't always sit well with some of her colleagues, who viewed her as a professional threat. Her office was broken into and she received anonymous written threats indicating that she should relinquish responsibility for a project she was managing at the time. Incidents such as these led to her considering quitting engineering entirely.

As usual, she sought counsel from her family and from God. During this process, she strengthened her resolve to stay in her chosen profession and to defy anyone who came between her and something great. Her family encouraged her to upgrade her security at home, protect her children, push for more equal pay, remain true to herself and soldier on.

Family first – always

The demands that come with work and corporate responsibility take up much of Grace's time. At some point she deliberately decided to leave the office at a particular time without taking any work home.

Travelling for work has been a real challenge, because she has to ensure that everything is in place for the home to run smoothly during her absence. Strong social support systems have been vital and her sister, for instance, comes over to look after the kids when she travels.

Support and encouragement, not vindictiveness and competition, follow success. Today, Grace can count many of her co-workers as close friends and allies. These colleagues have been true voices of encouragement during her professional and personal progress.

Most of the women Grace has worked with have been highly supportive and appreciative, and every bit of her success has been worth the sacrifices. She believes we must persevere with integrity and dignity in our endeavours. In this way we can prevail and lead, carving a path in which the next generation may follow. She is proud to be a pioneer and champion for Zambian women and other female engineers on the continent.

JOURNEY 27

QUEEN OF THE PROFESSIONAL JUNGLE

Juliana Pallangyo
Founder and CEO of GENI
Energy Consulting Firm
TANZANIA

Juliana Pallangyo was born in 1959 in the Tanzanian region of Shinyanga, the second eldest of what would eventually be 11 children. Her father, Leonard Kajala Sengo, followed his own challenging journey from farming to becoming a police officer and her mother, Elizabeth Madale Gille, was also a farmer and later a tailor who passed away in 2019.

Julie, as she is fondly known, recalls being the only daughter in the family for quite some time – the second girl was only born when she was nine – and how her father, though not a wealthy man, would shower her with affection and call her his favourite child. Perhaps it was the early validation that turned her into a woman who was able to not only survive but thrive in the male-dominated world of electrical engineering.

ABOUT THE AUTHOR



Juliana Pallangyo is the founder and CEO of GENI Energy Consulting Firm, which offers consulting services for hydro power plants, power lines, renewable energy, oil and gas projects and initiatives.

She has worked as the deputy permanent secretary at the Ministry of Energy and Minerals, supervising the energy portfolio. She was involved from the initial stage of implementation on two major government projects: the East Africa Crude Oil Pipeline from Hoima Uganda to Tanga Tanzania, with a length of 1 445km, and led the technical team implementing the Julius Nyerere Hydro Power Plant project, generating 2115MW. Juliana has chaired or acted as a committee member for multiple organisations during her tenure.

She has worked at the Tanzania Electric Supply Company (TANESCO) as a planning engineer, senior engineer, principal liaison engineer, principal sales and marketing engineer. She has also been the chairperson of the Corporate Loss Committee (CLC), a member of the company board of Survey and a member of the National Energy Efficiency Action Plan (NAEEAP), with more than 30 years' experience in the sector.

Juliana holds a PhD in business administration management DBAM (HC) and a Dipl.-Ing. (MSc) in electrical engineering from the University of Applied Sciences in Cologne, Germany. She is a consulting and professional engineer, registered by Engineers Registration Board, a corporate member of the Institute of Engineers Tanzania (IET) and a prominent member of the IET's women chapter. In July 2021, the IET presented the Mama Mhandisi Award for the best woman engineer in tech-entrepreneurship to Juliana, as head of GENI Energy Consulting Firm at the 6th TAWECE conference.

Juliana is a founding member of Karibuni Freundkries Tansania Deutschland e.V, an NGO founded in 2001 at Leverkusen in Germany. The NGO strives to help underprivileged girls and orphans in Tanzania. Since 2001, the NGO has managed over 128 projects/programmes on youth and women by paying school fees and grants, and educating them in various capacities.

Since those early days as “daddy’s girl”, Juliana has faced many challenges, but managed to make it through with flying colours. Even though she’s technically retired, she doesn’t sit still for long and is the CEO and senior consulting engineer of her own consulting firm, GENI Energy Consulting. She says her road to success was winding, with many challenges along the way.

The little girl who could

The Tanzania of the 1960s and 1970s wasn’t exactly known for gender equality. In her Sukuma tribe and community, girls were valued because they brought the hope of dowry to the family. They were however not treated as equals and were seen much more like possessions.

It was different for her, though. In her family of five girls and six boys everyone was treated the same, sharing household chores equally. From an early age, her parents instilled in her and her siblings the importance of respect for others – sometimes forcefully. She recalls her mother being strict with them in an effort to turn them into good citizens. Their father, on the other hand, would politely scold them, but never raised a hand to them.

Juliana recalls being strong-willed from a young age. When she went with her mother to enrol her elder brother in primary school, the young Juliana insisted that she also wanted a uniform to attend school. The headmistress told her mother to just leave her there, and that she’d soon tire of learning. But she didn’t, and by the end of the day her parents had to relent: they bought her a uniform and enrolled her a year early.

It was this strong will that would repeatedly prove to be Juliana’s

salvation on her journey through life.

The STEM spark is lit

It was in Kazima Secondary School when something her brother told her made Juliana's hackles rise, and she doubled down in pursuing her dream. He told her she was wasting her time in taking science subjects because by the time she reaches Form Three, she wouldn't be able to pass. It was her desire to prove him wrong that spurred her on to work even harder in all her science subjects.

Although she initially dreamed of becoming a medical doctor, she was inspired by her uncle's lifestyle. As an engineer at the Tanzania Electric Supply Company (TANESCO) he travelled a lot, including attending courses internationally. This lifestyle and career choice intrigued Julie, and she wondered whether she could also pursue it.

It wasn't just as easy as deciding to become an engineer. Her family, community, teachers and friends all told her to consider what they called "light" jobs: secretary, accountant, nurse or lawyer. The hard jobs were for men, they said. Once again, her strong will proved to be the tipping point. Rather than be discouraged, she set her mind to proving them wrong and enrolled in a three-year electrical engineering course at the TANESCO Technical Institute (TTI).

Buckling down and pushing through

Juliana came close to giving up early on in the course when she realised she was the most inexperienced in her class. The other students had all come from job training or vocational schools where they'd gained a base

knowledge of engineering, while she'd graduated from a regular secondary school. She went home and begged her uncle, Eng Richard Gille, a respected elder in the clan, to let her transfer to a different college. But in his wisdom he wouldn't let her. He told her that everyone struggles for the first three months and things would improve after that.

This was a lesson in the power of perseverance, and Juliana says although those first few months felt like hell and she barely knew anything, she stuck with it and worked hard. Three months in, she was passing all her subjects, and by the end of the first semester she was the best student in almost all her classes. "It was like a miracle," she recalls.

She also met with some nasty resistance from her male classmates. When she started doing well, they started a rumour that the marks she achieved were because she was sleeping with her male teachers. Mortified, she once again doubled down and employed her iron will, working hard to do even better. In April 1981, she graduated at the top of her class – not bad for someone who wanted to quit just three short years before!

Alone in a foreign land

Juliana met the man she'd marry while she was studying at the TTI. After graduation, she had to do a year as an army conscript and they got married in 1982. Her husband, Wariael Pallangyo, an army officer at the time who would later achieve the rank of colonel, was supportive of her career in electrical engineering, telling her she could do anything she set her mind to. To that end, she was later accepted for a master's degree in engineering at the University of Applied Sciences in Cologne, Germany.

This is where she first encountered just how hard it could be for a woman in a male-dominated industry – she was the only female student in a class of 70!

There were many challenges to overcome in Germany, language and culture being among them. While attending a seminar for foreign students, she was asked what she struggled with most, and for her it was the complete isolation. “I had to tell them that no one sits near me or speaks to me. And I said: ‘How can I pass my exams if I have no contact with other students in the same class?’”

In response she was told that most German people are very reserved and that she’d have to go out of her way to speak to them if she wanted any kind of contact. Luckily, she got along with most of the other students on the female campus, as many of them were from Africa too. It was only in class that Juliana struggled, as the other foreign female students all studied other courses and not engineering, as she did.

Academic language was another barrier, as German wasn’t even her second language, but her fourth – her mother tongue is Sukuma and she also spoke Swahili and English. She recalls her first two years at the university being really difficult because of this, and she only managed to become fluent in German by her third year.

She probably wouldn’t have graduated if it hadn’t been for her electrical technology professor, Dr Berger, who saw her distress and offered to help. He had her delay her exams and offered to tutor her every two weeks to make sure she was keeping up. She remains grateful for his mentorship to

this day.

A fight for what is right

Juliana also had to contend with a legal battle and launch a case of unfair dismissal against her employer during her later studies. She had been accepted into the MSc programme at a German university and had permission to travel there for part of her studies, leaving Tanzania in 1999, when her daughter, Maria, was four years old.

In February 2000, her employer informed her that they were terminating her position, claiming that she had left the country without their permission. She says it was an attempt by the then-director of human resources to obstruct her career goals. Juliana refused to accept the unethical dismissal and sued the organisation after her return to Dar es Salaam in 2003. She was officially reinstated in 2005. This was a great victory and validation for her.

Giving back at home

By the time she returned from Germany in 2003, her daughter was already seven years old. Juliana recalls her family and clans – both her and her husband’s – throwing her a welcome home party, and everyone being extremely proud of her achievement.

She continued working at TANESCO as a planning engineer, working in the Kinondoni South region. While most of her fellow students who’d gone to study in Europe were offered jobs in those countries, or got married there and stayed, Juliana says she chose to return to her family and to serve her country. She credits her husband and family with supporting her throughout her time away and making it possible for her.

The queen ascends

Thanks to her degree from a German university that was widely considered to be top of the industry, she noticed a distinct deferential attitude in her male colleagues especially that hadn't been there when she was a technician. There was newfound respect, especially if she recalls the way she was treated prior to receiving a professional qualification from a European university.

Thinking back to her time as a technician, she recalls encountering one supervisor who didn't like the fact that she was a woman. He would ignore her as much as possible, and instead of summoning her to his office with instructions for her department, he'd send junior employees to deliver the message to her. Luckily, she didn't work there long before she left for Germany and after her return she was treated with much more respect. She stayed with TANESCO after returning from Europe, serving the Dar es Salaam Kinondoni South for four years. She was then transferred to the head office, holding various positions in the organisation over a seven-year period.

In government

As she progressed in her career, later becoming Deputy Permanent Secretary for Energy and Minerals in the Tanzanian government, she increasingly experienced greater deference from male counterparts. It was then that she came to feel like a proud queen in a male-dominated professional jungle. She had earned her stripes and gained respect through hard work and achievement.

But Juliana says it makes her uncomfortable to be treated differently as a woman – she would prefer to be treated equally, on merit. “We are all engineers, after all.”

Life and career: looking back over it all

When it comes to family life, Juliana credits a support network that included her mother and domestic worker of 17 years, Imelda, who'd practically raised her daughter. Although Julie's mother lived 900km away, she'd also visit as often as possible to help. After a short hiatus when her Maria left the nest, Imelda is back with her. “She is like family now,” Juliana beams.

If she had any regrets, Juliana says it might only be that she didn't spend enough time with Maria as she was growing up, to the extent that Maria once asked her mother if she even loved her, as she was feeling neglected. At that stage, Juliana was working as a senior engineer, which took her away from home a lot. When she was promoted to principal engineer, her family hardly saw her at all. She took comfort only in the fact that she was setting an example of hard work and determination for her daughter. By the time she was working for the government, she was spending almost no time at home, she recalls. She was always in meetings, including parliamentary budget meetings, investment meetings, or soliciting funds for rural and power projects. Her daughter, now a medical doctor, had already gone off to further her medical studies in China at this stage. Her beloved husband

sadly passed away in 2011.

After Maria moved away and her husband had died, work became her sole passion, Juliana says, adding that she rarely took time off unless it was absolutely necessary. She took a total of seven days' leave when her father-in-law passed away, and she had to take time off to see her parents when they were ill.

Throughout her career, she tried hard to balance her work responsibilities with her family life. But it was tough when she worked for the government, as she had to leave the family behind in Dar es Salaam while she worked in the capital city of Dodoma.

Then there are the financial burdens. Juliana says that it's traditional in Tanzania for those who can afford it to help other family members with their education, and she still pays the school fees of around 30 children in her family, including nephews and nieces.

Empowering the next generation

Juliana, who has her own consultancy firm, is very involved in empowering a new generation of women in engineering: "My responsibility is to encourage women to study science subjects," she says.

To that end, she's been the chairperson of the Queen of Family Girls' Secondary School in Kahama for the past 15 years. The school, which is run by the Catholic Church, has produced more doctors and engineers proportionate to other professions. She acknowledges her responsibilities

as an accomplished woman in a developing country, and doesn't shy away from hard work. "There's a lot to be done, therefore challenges for women are many compared to women in developed countries," she explains.

During her time studying in Germany, she attended various workshops and seminars on empowering women, especially young women who become pregnant in school. Thanks to these workshops, in 2001 the NGO Karibuni Freundkries Tansania Deutschland, which supports and empowers girls and orphans, was formed. After finishing her studies in 2003, Juliana rolled out the project in Tanzania. The NGO started by educating girls and orphans by paying school fees, giving grants and donations to orphanages, advising and helping women groups to gain knowledge, skills and tools for the workplace.

The NGO has managed over 128 projects for the youth and young women, educating them in different fields. The programme now offers courses for nurse attendants, midwives, economists, electrical artisans, mechanical artisans, personal assistants, typists and accountants, skilled labour and hairdressing, as well as tailors and small business entrepreneurs.

The beautiful engineer in the red dress

Juliana's myriad professional achievements are doubly impressive for someone who fell into engineering by accident, as she puts it. She was on the verge of quitting many times, but her iron will prevailed throughout – and Tanzania and its women are no doubt better off for it.

She says over the years she has counselled hundreds of schoolgoing youngsters and worked hard to battle the perception in Tanzanian society that “only ugly girls study engineering”. To them, she says, “Look at me! I am beautiful. I am a proud woman and I am also an engineer!”

One of Juliana’s favourite anecdotes comes from an occasion where she visited the Queen of Family Girls’ Secondary School to address some Form 2 girls about possible careers in STEM, and specifically engineering. That day, she recalls, she wore a bright red dress with high heels and spoke with confidence to her adolescent audience, inspiring them with her story.

“There was a young girl who has since told me that on that occasion she was so entranced by my look and my story that she said to herself, ‘One day I want to be just like her!’”

“The problem was, she has subsequently explained to me, that she was not very good at mathematics and had average grades. She knew that to become an engineer she would need excellent marks for maths and science.”

“After my talk, she ran straight to the headmistress to ask her advice about how to improve her maths marks, and apparently the nun reminded her of a tree she had planted in the school gardens, along with other pupils who each had their own tree.”

“The headmistress told her that when she watered her tree every week, she should talk to it and ask it to help her. The nun explained that when you water something and give it care and attention, it will flourish, and

that that is what she needed to do with her mathematics.”

“Apparently she practised every day and did extra work and finally got top marks in her maths class. That young woman now works at the Institute of Science and Technology in Dar es Salaam as a tutorial assistant, and says she will one day be a professor!”

The story always makes Juliana smile, she says. And who can blame her? She has after all become a reigning queen in a male-dominated professional jungle.

JOURNEY 28

CREATING SPACE

Vangiliya Pereira

*Deputy General Director at the National
Space Programme of Angola*

ANGOLA

From civil war to space: reaching for the stars

As a child of the 1980s born in war-torn Angola, Vangiliya Pereira has come a long way to her leading role in her country's space programme. Her official title is Deputy General Director for the Technical and Scientific Area of the Angolan Management Office for the National Space Programme (GGPEN), and it's every bit as impressive as it sounds.

Ványa finds her life and burgeoning career immensely satisfying, while also playing mother to a 17-year-old daughter and two young boys of nine and six – all of whom she describes as “simply amazing kids”. Her journey to this point hasn't been without its challenges and disappointments. There have been casualties along the way, including the breakup of her marriage. Still, she says she wouldn't have it any other way, because, quoting the

well-known vulnerability author and speaker Brené Brown, “only when we are brave enough to explore the darkness will we discover the infinite power of our light”.

To look for something good

Vânia's full first names, Vangiliya Yotana, mean “to look for something good”. These were given to her because her mother had struggled with infertility prior to her birth. She says her mom described her arrival as “opening the gates of heaven” because after she came, four more daughters followed.

ABOUT THE AUTHOR



Vangiliya Yotana Ribeiro Filipe Pereira has worked as a technician and manager in the telecommunications field for over 18 years. She holds an engineering degree in electronics and telecommunications from the University of Bradford in the UK and an MSc degree in mobile and satellite communication from the University of Glamorgan in Wales.

Vânia specialises in the design, architecture and operation principles of satellites. She has been certified by the Russian Space Agency as a satellite operator, having previously exercised the function of shift flight director for the Angolan Satellite Mission Control Centre. She is also certified by UNISEC in the design and assembly of small satellites (HeptaSats) and has been actively engaged in the SADC satellite shared network committee and SADC Digital TV.

Since 2011, Vânia has worked at the Ministry of Telecommunications and Information Technology in Angola, starting off as a consultant to the secretary of state for telecommunications on subjects related to digital television and the National Space Programme of Angola (Gabinete de Gestão do Programa Espacial Angolano/GGPEN). She assumed her current role of deputy general director in July 2018.

Her name is also a kind of personal motto and she seeks to always find the good in any situation, to count her blessings and to make the most of her opportunities.

Thinking back to her childhood in the early 1990s, Vânia recalls bullets flying and bombs exploding in the centre of Luanda where she lived with her mother, an architect, and four siblings in a single-parent household. Sometimes, if they wanted to move around the house, they had to crawl on their bellies, and other times they'd spend days holed up in one part of the house. Her father, a cardiologist, lived elsewhere with his wife and their children, all of whom Vânia got along with well, and still has a wonderful relationship with. "My mom and stepmom talk very often. It's unusual, but it's also wonderful."

The STEM seed is planted

As professionals, her parents placed a high value on education and supported all their children in this area. The fact that she was a girl made no difference in their respective households – all children were treated equally when it came to learning opportunities. Vânia's mother worked long hours and as a little girl she recalls not always understanding why her mother wasn't around a lot. Now a mom herself, and with her own burning passion for her career, she says she understands the challenges the world brings to women, particularly to mothers and even more so to single mothers.

As the eldest, she had to learn the responsibilities of leadership from an early age. Probably because her parents hadn't forced gendered education

ideas on their children, she found herself drawn to the STEM subjects when she was still at school.

Vànya started dreaming of studying engineering, but then came the first hurdle: the Angolan education system fell short at the time. Her parents came to the rescue and helped her get to the UK to follow her dreams, and she enrolled at the University of Bradford in West Yorkshire.

Leaving the nest and ‘hail Britannia!’

As an engineering student in faraway England, Vànya faced several challenges. Up to that point, her education had been in Portuguese, and in England she had to digest a tertiary education in a different language.

The UK also had a whole new learning system. The way mathematics and physics were taught at the university differed vastly to how it had been taught in her home country. On top of that, there was the cultural adjustment. Though she says Bradford’s student body was fairly diverse and included several other students from Africa, there were only a few Angolans. There was no one in her circle who shared her cultural heritage and whom she could confide in if she struggled to adjust, and home was very far away. No wonder she describes her first year at university as “awkward and intense”.

And, of course, there was the gender issue in science and engineering – 95% of her class was male. But, just as her parents and church at home had taught her, she was tenacious and wasn’t going to let that stand in her way. She simply worked at befriending more male students, building up a support network. Although her male counterparts were mostly supportive,

she found it hugely frustrating that in joint projects they'd assign her the theoretical tasks such as taking notes or writing reports, while they'd do the practical tasks, telling her that her hands were "too soft" for the practical work.

On top of that, there were moments when they would flirt with her. She had to stand firmly on her values and purpose that took her there in the first place so that they would show her more respect and treat her as they did other male colleagues.

But why engineering?

Knowing that the STEM areas are male-dominated and that her career would present many challenges, why choose engineering? There was certainly the example set by Vanya's architect mother, but there was also the simple realisation at the time that she was good at identifying a problem and trying to find a solution. She'd always been drawn to science, technology and maths and enjoyed doing calculations over memorising facts.

It was also a practical choice. Because Angola was just coming out of a civil war and has rich oil reserves, she'd thought that a career as an engineer in the oil industry would be lucrative and help ensure job security. She'd also be one of the few women working in that field, increasing her chances of finding a job.

That course had however been cancelled at the university she'd already enrolled in, so she opted to study electronics and telecommunications engineering instead. It was a typical example of an engineering mindset. Vanya says that engineers are born problem solvers and typically approach

life and work pragmatically and by being sensible and practical (without being boring). To be a successful engineer, Vânia says you need to be flexible, adaptive, open-minded and innovative, because the field is constantly evolving.

Discipline and focus are also essential to success. Vânia loves meticulously working through issues and systems glitches and developing solutions, and is thrilled to be following the path fate led her to. By specialising in telecommunications, she now gets to learn how to design, build and launch satellites into space!

Aim for the sky: Vânia spreads her wings

Yet another challenge emerged during Vânia's placement year when she discovered that it was near impossible for a foreigner to get a placement in the UK. Once again, her parents were the heroes in her story. Having travelled extensively in their own respective careers, they could provide valuable advice and guidelines.

Instead of just one placement, Vânia did three that year: six months in Portugal, at Portugal Telecom, two months in Angola, at Angola Telecom Company as a signal transmission officer, and four months in China, at China Telecom Company as an ADSL modem installer.

Again, what stood out for her was how few women worked in the field, especially in the technical division. But she was determined to not let cultural differences, gender or the working environment keep her from doing the best she could. And her best was so good that the university awarded her the best placement report that year. She says the lesson she

learnt from that is: “We shouldn’t let anyone define what we can or cannot do, because where our greatest discomfort lies is also where our greatest opportunities reside.”

Back to her roots – the engineer in a skirt (and heels)

After graduation, Ványa returned to Angola to obtain work experience. As a qualified electronics and telecommunications engineer, she was working at a telecommunications company when given the task of coordinating a group of technicians on network installation devices. This was her first time in a managerial position in a male-dominated field. She describes the experience as “not easy”, which is perhaps an understatement. “Wearing skirts would bring the wrong impression of fragility and vulnerability,” she says, and she had to adapt to her new role.

Ványa has come a long way and has gained confidence. She is unapologetic about rocking a pair of three-inch heels while handling a wrench and fixing a technical problem hands-on. “I see the eyes of my male colleagues widen in disbelief, but I am all-woman and all-engineer at the same time!”

It feels good to break down stereotypes about how a so-called woman engineer should look or act.

Space: the new frontier

Ványa had just completed a postgraduate certificate in management when she learned of plans for Angola to start its own space project in order to launch the country’s first telecommunications satellite. The project, run by the former Ministry of Telecommunications and Information Technology, excited her no end. She immediately realised that this endeavour presented

immense opportunities.

She approached the ministry to express her willingness to be part of the initiative and was provisionally accepted, although she needed more training. Not one to wait for opportunities to come to her, she enrolled for a master's degree in mobile and satellite communications at Glamorgan University in the UK to improve her chances of selection. And she went straight to work.

Ványa describes her proudest professional moment to date as watching Angola's first space satellite launch in 2017, knowing how many years and how much team effort it had taken to reach that point. Being an intrinsic member of the team that is helping to create comprehensive telecommunications infrastructure of a global standard in her previously war-torn nation is exceptionally gratifying.

Angola's space programme explained

Ványa explains the motivation behind Angola's developing space programme as follows: Africa as a whole still faces major connectivity issues due to lack of adequate telecommunications infrastructure in many regions. Angola's civil war left a nefarious legacy in the form of many unexploded landmines that still scatter the rural landscape. This makes the laying of fibre optic cables extremely dangerous work, and quite expensive. In order to stop paying premium prices to external providers for connectivity, satellites can help Angola run its own telecommunications infrastructure more cost-effectively.

To ensure national security (protecting the country's borders), as well

as to source valuable insights for the agricultural sector and investigate potential water supply sources, do urban planning, etc. satellite imagery can be extremely helpful.

None of this would be effective without human resources and intensive training. That is why more than 45 technicians had to be trained in design, architecture and operation principles of satellite and certified by the Russian Space Agency as operators of satellites. Vânia was among them.

Angola developed a comprehensive space strategy for implementation between 2016 and 2025 and it is as this project reached fruition that Vânia joined the leadership team. “Our space programme allows us to take our power back as an African nation and potentially also serve other countries on the continent and beyond with affordable telecommunication options,” she explains.

The professional and personal juggling act

Then love came knocking. Vânia got married the same year she obtained her master’s degree. She returned to Angola, where she found herself suddenly involved in two life-altering projects: initiating the space programme in her role at the Ministry of Telecommunications and Technology on the one hand, and marriage and starting a family on the other.

It wasn’t easy juggling the two, and things got even harder when her first child was born. She was still breastfeeding when she had to travel to Luxembourg to attend a space-related course, and she was faced with the

tough choice of leaving her baby behind or taking him with her.

Luckily, her managers and husband were understanding and supportive, so she ended up taking her baby boy with her to Luxembourg. Even that decision provided unique challenges. During the day, as she was attending her course with her all-male colleagues, the baby was left in the care of a nanny. Whenever she had a break during the day, Vânia would rush over to her accommodation to breastfeed her son. It was certainly not a complication any of her male colleagues would ever have to deal with.

History repeated itself three years later when she had a second baby and had to attend a 45-day course abroad. This time, she didn't have the option of taking her six-month-old baby with her. She describes the decision of leaving him behind as feeling like a knife to the chest. He was still breastfeeding and had to be weaned while she was away.

This experience, she says, was the closest she came to giving up her career to raise a family. "I felt so guilty that I started wondering if it was all worth it." But she stuck with it, and as time went by, she was given more and more responsibility with the space project. This was also thanks to the fact that she had a supportive manager whose vision was to give equal opportunities gender-wise and bring out the greatest potential of his staff, which helped her overcome those challenging times more easily, she says.

Difficult choices

Something had to give with all she had on her plate, and in the end it

was her marriage. Torn between her passion for her career and her love for her family, Ványa struggled to keep all the balls in the air. It didn't help that she was constantly surrounded by male colleagues and spending more and more time away from home travelling due to the nature of her work, which on top of other things brought a lot of setbacks in her marriage life.

Ever logical, eventually she sat down and took a long, hard look at her life. She realised she couldn't have it all: work, marriage, kids and household all perfectly set. There would be trade-offs and after some time of pain and struggle, she and her husband made the excruciating decision to part ways.

Although it was really hard, she got through it with the support of friends, family and colleagues. Mixed with her strong inner faith, she picked herself up, dusted herself off and carried on with her journey because, she says, “failure is not the opposite of success, but part of success,” and “happiness isn't just a state of mind; it's a decision”.

Keep rising!

Today, Ványa is a strong, independent woman at the top of her profession, while raising children by herself. She's one of only a handful of women certified as satellite specialists, playing a leading role in Angola's space programme, and is fondly known as “the Angolan astronaut” among peers. Despite her achievements, she remains humble and driven. A major lesson for her as a female manager in a male-dominated field has been to adjust her management style. She acknowledges that in the past she tended

to make decisions on a more emotional level, and that's something she's learnt to deal with.

Over time she's become more straightforward in her approach, and more calculated, as that's something she's observed in her male counterparts.

She regrets little and says she's happy and fulfilled. "My job is amazing and I get to work on interesting projects and meet wonderful people in the process. I have the most amazing kids, who are the motivational force for getting up every day and getting the job done. My daughter wants to be an engineer because she has seen how much job satisfaction I get. I also have wonderful parents who paved the way for my career."

She feels empowered by the change she can make as an engineer, and wants to inspire more women – especially African women – to not let their skirts hold them back from choosing engineering as a career.

"It may be scary to start a new journey, especially if it's as challenging as this, but later on you'll realise that it would have been a greater pity if you didn't do anything about it. Opportunities don't happen; you must create them!" she says emphatically. "The first thing you should do, as Mark Twain once wrote, is to keep away from people who try to belittle your ambitions. Small people always do that, but the really great ones make you feel that you, too, can become great."

JOURNEY 29

ISE LAA FII DENI GIGA: IT IS WORK THAT PROMOTES GREATNESS

Kehinde Taiwo

*Professor in the Department of Food
Science and Technology at Obafemi
Awolowo University*

NIGERIA

Tenacious beginnings: Coming of age in postcolonial Nigeria

As the youngest girl out of nine children, Kehinde Taiwo grew up with three sisters and five brothers in Kano in northern Nigeria. Her father was a building caretaker and debt collector, and her mother an informal trader, selling anything from food to hawked items such as gold jewellery and fabrics. Her parents were not educated but could read and write, her mother having completed Grade 4.

She was born in 1962, at a time when it was not common for girls to go far in their schooling, and Kehinde's father only provided money for the boys of the family to get educated. He had no objection to his daughters going to school, but as they were part of a patriarchal society, paying

exclusively for one's sons' schooling was simply the done thing.

Kehinde's mother was determined to get the girls educated, and although it was challenging, resolved to find a way. She refused to have her daughters drop out of school early and become teenage brides, which was very much the norm at that time.

Hope is a teacher

Hope came when the eldest two daughters managed to get into the

ABOUT THE AUTHOR



Kehinde Taiwo is a professor in the Department of Food Science and Technology at Obafemi Awolowo University (OAU) in Ile-Ife, Nigeria. She has a BSc in food science and technology, an MSc and a PhD in agricultural engineering from OAU.

Her research interests are in food process engineering, gender studies and industrial technology management in relation to the food industry. She specialises in resource mobilisation, institutional strengthening, research management, networking, gender issues, postharvest processing, technology policy and management, research uptake and fundraising.

Kehinde has won numerous awards, scholarships and grants, and has participated in several international research initiatives. She has also supervised several postgraduate students. She is a fellow of the Nigerian Society of Engineers (NSE) and the Nigerian Academy of Engineering (NAE), and director of the Linkages & Partnership Unit. She has served as head of department, vice-dean and dean of OAU's Faculty of Technology and later became director at the University's research office. She has also served as vice-chair and later chair of NSE's Ile-Ife branch. She is a member of several professional bodies and is registered with the Council of Registered Engineers in Nigeria.

women's teacher training college, which was free of tuition fees. They were able to secure jobs after graduating and send money home to pay their third sister's school fees, who in turn got a job after graduating and was able to pay for Kehinde's education. The girls took care of one another, much to their mother's delight.

Aside from the incredible support from the women in her family, Kehinde also fondly remembers the help she got from her eldest brother while she was in her final year of primary school and was preparing for the high school entrance exam. He was doing his master's degree at a university in another city at the time, and he came home every weekend for three months to tutor her and her twin brother for their upcoming exams.

It certainly paid off, and both she and her twin were accepted into a prestigious high school thanks to excellent results.

Steered in the right direction

Growing up, Kehinde says that although she was aware of science-based subjects, she never really linked them to engineering. After completing high school, she signed on to study biochemistry at what is now called the Obafemi Awolowo University (OAU). At the end of the first year, engineering came knocking.

Knowing she had an aptitude for mathematics, her brother-in-law suggested that she switch to the Faculty of Technology. There wasn't any female representation in engineering at that time, and he saw a bright future for women in the field. Kehinde was intrigued and changed over to food science and technology in her second year.

Kehinde's course was actually one of the very few dominated by females in the Engineering Department – her class had eight women and five men. Even though she was in a male-dominated department in terms of the staff, Kehinde never felt she had to prove herself just because she was a woman in a “man's” field. Holding the position of both top student and class captain for four straight years, her academic achievements spoke for her.

When it came to postgraduate studies, Kehinde's brother-in-law helped steer her forward and upward again, encouraging her to cross over to agricultural engineering for her master's degree. She registered at postgraduate level and sat for exams in additional undergraduate courses to make up for the gaps in her engineering background.

These additional courses enabled her to take the professional engineering examination and pass it. It was another testament to her drive and tenacity. Kehinde firmly believes in the Yoruba saying “Ise laa fii deni giga”, which means it is work that promotes greatness. She is a living testimony to this adage, she says.

Not holding out for a hero, but being your own

When it came to finding a suitor, Kehinde says a relationship was far from the top of her priority list. As an avid reader growing up, she detested books where the female lead was presented as helpless, penniless and needing a man, and instead preferred books where the heroine could stand tall on her own. This narrative was becoming popular, as urbanisation helped girls make their own way in life.

This attitude was further ingrained by her mother, who instilled in her

the notion that girls could do anything as well as boys. Her older sisters, three educated and independent women who never took nonsense from any men, also helped.

Kehinde had clearly internalised these powerful messages, choosing to focus on her studies and empowering herself through her education. She was never going to let life pass her by while waiting for a man.

Her fellow male students knew to respect her boundaries, but an uncomfortable encounter with a lecturer during her undergraduate studies left her a bit rattled. He slipped her a note during a test, asking her to lunch. Kehinde didn't take him up on his offer and could soon tell things had become uncomfortable in class. She ended up getting a C, even though she worked incredibly hard, but says she was just happy at the time that he didn't fail her.

Kehinde kept her head down and continued to work hard at her studies when love came knocking. She met her future husband while studying for her doctorate. Kehinde says that the relationship fell into place naturally, as her husband is a fellow engineer. He is very supportive of her career and she says she greatly appreciates that he champions her in achieving her goals.

Never backing down and knowing your worth

Kehinde's professional stature is undeniable. Her senior colleagues are proud of her accomplishments and her junior colleagues see her as a role model. This esteem, however, was not easily won. Kehinde has faced much discrimination in her career, often in the form of unfair and nefarious allegations.

Her head of department accused Kehinde of having committed a bizarre act labelled as ‘self-plagiarism’ in 2005, just when she was about to assume a full professorship. This was because there was a tenuous link between two papers she had submitted for publication – one under technology management and one under food science. The fact that her husband was the faculty dean and could not preside over the case was also quite tricky.

Kehinde vehemently defended herself against the accusations and proved them unfounded. In the end, the faculty review panel gave the department an ultimatum to submit her papers, on the grounds that her fundamental human rights were being violated. The pronouncement regarding her promotion to full professor was finally made in 2010, not least because Kehinde is a naturally vocal person who stood up for herself. She makes decisions and harbours opinions unashamedly. She articulates her points well and is never too shy to express herself.

“Speak your truth and never be silenced,” she says adamantly.

One person’s busybody is another person’s doer

Kehinde has not escaped judgement from people in her personal life, either. A friend of hers accused her of being a busybody, which made her shy away from volunteering for tasks. She has also not escaped the snares of fierce competition and institutional sexism.

She says that a senior colleague responsible for the delay in her promotion was a woman. In the early 1990s, a senior female colleague instructed her to be wary of the way she walked and to avoid direct eye contact with male colleagues at departmental seminars or meetings. Looking her male

colleagues in the eye was considered an affront. In both cases, however, Kehinde shunned this approach and maintains that the only man she submits to is her husband.

These things might seem petty, but they speak volumes about what Kehinde was up against as she made her way to the top. Her advice to the youth is that one must work hard and not expect good fortune every step of the way. One must believe in one's own abilities and neither hold back nor back down.

Turning caterpillars into butterflies

Kehinde sees nothing particularly significant about her professorship. She is more interested in societal transformation and true science. She has the ability to perform alchemical feats. Recently, for instance, she secured a grant to construct a diesel-oil-powered boiler. The boiler generates steam to operate equipment (drum dryers, climbing film evaporators, fluidised bed dryers) that had been abandoned for lack of steam supply.

Kehinde has also fulfilled many other roles and positions. She has been a financial secretary and filled multiple vice-chair and chairing positions for a variety of committees and organisations. She also served two terms as the first female vice-dean (2011-2012) and dean (2014-2016) in the Faculty of Technology. She maintains that the issue of being a woman is not overwhelming for her because she has a strong character and is able to do what many of her male colleagues fear to do – challenge the status quo.

Making it all work

When it comes to family, Kehinde says modern appliances, working after

hours at home and having a supportive and understanding husband are the keys to maintaining her work/life balance. She prepares meals in advance and says her husband doesn't mind defrosting these soups and stews in the microwave for family dinners, especially if she's away for work. The couple even has a generator to keep the freezer going if there's a power outage.

She also has help around the house to take over some of the domestic duties. Some of her colleagues' husbands don't allow this, but it has been a huge help to her.

Kehinde travelled a lot when her kids were young while her husband stayed home, and she in turn stayed home when he needed to travel for work. She says she doesn't recall a time when both of them were away from home at the same time.

In addition to getting help in the home and appliances that ease the burden of chores, Kehinde leaves the office and takes work home so that she can be with her children. Growing up, her kids could always come and talk with her and tell her about their day. She would attend to them and then continue with her work. She gets to bed late and rises early to keep up with her busy schedule.

When it comes to instilling values in her children, Kehinde says she has a lot to give. As an educated woman, she has a keen interest in current affairs and can actively participate in discussions and healthy debate with her children. Academically, she's a great asset to her children and able to regularly advise them on their schoolwork.

As a financially independent woman, Kehinde feels grateful that her

children can see her as a role model who doesn't require permission from the man of the house to get things done and is active in pursuing her goals. In this way she can be a vital role model in showing her children that, just as her mother had always told her, "girls can do anything as well as boys".

Kehinde also knows that no one can be happy without some leisure and social time. She says she is a social person and loves parties. "I work hard, but I also love social gatherings!"

She loves reading novels on her Kindle to unwind. "I like books by Virginia Andrews and Sidney Sheldon," she says with a smile. "I am always reading something for pleasure, in-between my heavy workload."

Hopes for the future

Kehinde believes that although much energy and resources are used to train female science and technology graduates, not enough goes into ensuring they find and retain jobs. Too often she sees graduates not working in their field of study.

She believes that improving working conditions might change this. And things have indeed improved. There are now over 10 000 registered female engineers in Nigeria – a far cry from when she began.

Either way, she thinks that the perception of working women has changed over time. Economic power trumps marriage for the new generation. But that only really holds for the educated class. Many uneducated people still see marriage as an escape route from poverty.

Kehinde does not think that women in Africa face more challenges than women around the globe. People are human beings everywhere, with a tendency for oppression. The major difference is that in developed countries, the law enforcement agencies are more supportive of abused women, she says. In Africa, people often say it is a part of life; everyone has their own challenges and know how to cope with it. Traditional culture does not favour women, but with so much sensitisation and awareness, things are getting better.

Kehinde's dream is that women will have the confidence to stand on their own and attempt great things. She relates how she once met a final-year female student who was top of her class. Yet all she wanted to do after graduation was get married, have children and teach at a secondary school.

Kehinde would prefer to see more women stepping up and attempting to reach greater heights. She wishes to see women stand tall and take their rightful place, without relying on men for their success. Women deserve to be respected according to their achievements and for their unique skills, she says.

“Just be a professional. I have succeeded in life because I have not been afraid – to take initiative, to lead or to upset the apple cart or the status quo when it was needed. We must fight for what we want and for what we believe in,” she says. “Don’t keep quiet about things that matter. Keep fighting for what is right.”

JOURNEY 30

A SHINING LIGHT

Irène Yanpelda Wanghou

Director at WeeY Energies at Eau

CAMEROON

Sunshine girl

The far north province of Cameroon with its roughly 50 ethnic groups forms a culturally diverse population that ongoingly deals with issues like desertification caused by overgrazing and too many trees having been chopped down. It might seem an unlikely place to produce an engineer, and a female one at that. But Irène Yanpelda had heard the word “engineer” as a youngster, and as she grew, the word grew with her – its importance had imprinted itself on her young mind. Her fate was written, it would seem.

She particularly remembers admiring her uncle, a telecommunications engineer, and feeling perplexed by all his technical equipment, but she

remained somehow determined on becoming involved in technical specialisation herself. An interest was sparked and it grew as big as the sun. And talking about the sun, today communities benefit daily from solar installations that were created under her watchful eye.

It's your turn now

Born into a family where parents saw no reason to differentiate between boys and girls, Irène's father said that the Lord had given him children, and he would make no distinction regarding their gender but would do his best for them all. This resonated with the kids, who all grew up with the same rights and duties, including the boys taking turns to clean the house.

ABOUT THE AUTHOR



Irène Wanghou was born in 1988 in Cameroon. She holds a master's degree in renewable energy science from Université de Maroua. A leader in the field of solar energy, she focuses on strategies for sustainable development and environmental protection using photovoltaic energy and biogas.

She is part of the Cameroonian Association for Renewable Energy (ACER), whose members operate in a network to provide adequate solutions. The association deals with problems related to the environment and tries to come up with solutions. Irène is also a part of the Association of Entrepreneurs of Cameroon (AER), a leading outfit among women's associations.

Irène believes that self-acceptance, both personally and professionally, is one of the most important keys to success, and core to being a good professional. She also values collaboration in working environments, believing that people can help each other to find alternatives and create more space for proposals and solutions. She is a proud single mother to a charming little girl.

Mom drew up the roster, which changed every so often, and when a big brother wanted to cook over a weekend, the girls took care of the dishes. This household discipline is proof to Irène that the sexes were indeed equal, and would stand her in good stead during her university life.

Electrified

In Irène's youth she became captivated by electricity and how it could solve the region's problems. Constant power failures plagued her community. As she grew up, she would watch TV shows that demonstrated solar panels, and she found the fact that one could get electricity from the sun an enchanting and exciting concept. However, she was still fascinated by engineering, and this was the choice she made for her university career, because she "liked new things".

After obtaining her bachelor's degree at the University of Maroua, as luck would have it the university opened a higher polytechnical institute, and after much thought and site visits, Irène opted for renewable energy as a major. She admits that picturing her country without power shortages, and perhaps seeing herself play the role of someone who could be a solution and make sure there was stable energy, was an inspiring and attractive goal to work towards.

The legacy of a man who understands war

The influence of her beloved father again came to the fore. Irène says that when she and her siblings reached the age of maturity and understanding, her papa would hold early-morning meetings with the children. Much as they pretended not to wake at the knock on their door, their father insisted,

and once they were awake, he stressed the importance of studies. He told them that he would pay their dowries, but the most important thing in their lives for a while would be their studies.

Irène believes this to be his greatest legacy and gift to his children. He used to say, “I am a soldier and often at war. I can die at any time, but you must remain committed to your studies. This is what will make you great and help you create a great tomorrow.” This life advice served them well.

Only the best

At Maroua University, Irène found that she was one of five young women in classes of about 50 men, and in her specialisation year she was the only woman among 15 men. She laughs when talking about the treatment she received from classmates and lecturers. She laments that it was difficult to skip a class – she was too identifiable through her hard work and her teachers placed special pressure on her so that she would “save the honour of women”. She felt compelled to do things well and to distinguish herself as one of the best and brightest in the classroom.

When asked whether she thought things had changed for the current generation since she was studying, Irène’s reply was adamant. “Yes, things have changed enormously; government communication about renewable energy is increasing and there are investments in projects. For women, perhaps a little, but not much.”

Mentorship

Whether at work or still at university, there were natural challenges from a male-dominated world, and Irène says that the burdens were quite

heavy. On her journey, though, she met someone who was to prove her mentor, her beloved Professor Kolyang. He always believed in her and taught her quality and values like humility and patience. In proving herself in jobs well done, she was able to think consciously that she is a woman from the Sahel, a strong and determined Saaré woman.

Girl talk

The women on campus were very friendly, and they all knew each other and became close friends. They could talk about difficulties, and during these discussions they could find solutions together. Irène became a delegate from her dormitory, and from there president of the renewable energies club, which drew her even closer to her classmates. She smiles gently when she remembers sharing advice with the other women on setting limits for men.

Let the sun shine!

Community is a prominent part of Irène's make up, and as she finished university she walked straight into a different world, wanting to stimulate change in her society and bring electricity to the people, as she has dreamt of since her youth. After graduation, Irène's inner entrepreneur came to the fore. With a bold spirit, she established her own company, WeeY Energies et Eau, with a few like-minded business partners. WeeY focuses on renewable energy solutions in Cameroon, particularly solar installations.

Irène has already acquired five years of direct business and management experience, supervising interns and training young people in building electricity and renewable energy systems. She has never felt intimidated by men when going into the field; in fact, this is where she feels at the top

of her game. She sometimes works with her male colleagues until late at night if necessary, and she knows that they don't see her as a woman with so-called "women's weaknesses".

She's in control and ensures that everything is done to avoid errors. Simply put, Irène says, "I like a job well done."

Harness your own inner power

A natural born leader, Irène is proud of the fact that members of the Cameroon government appointed her as a consulting engineer to young entrepreneurs in her community. The University of Maroua has acknowledged her as their success story; she is the pride of the whole university and is privileged to be able to invite guests to any university event where she is involved.

The sun still shines brightly

There was little time to relax during her five-year postgraduate training period, and even when she was still a student, Irène has volunteered at RADEL, the Association of Endogenous and Local Development, gaining many extra technical and entrepreneurial skills. Once again, her dream of solar electricity supplies came to the fore, and she joined trainees from Germany to install solar equipment. Irène says that her volunteer activities were a great influence on her career choice.

Facing challenges in a male-driven environment, Irène established herself in that world by simply working hard, persevering and being dynamic. Her determination to uplift her community was always top of mind for her, and she is doing that by breaking down barriers and creating a strong

impact on the young people by saying “Yes, you can”.

She perceives herself as a leading solar engineer in Cameroon. She is stimulated in her work, passionate about what she is doing and realising her dream. Now, she believes, is the time to keep doing good to change and improve living conditions for her community, especially for the women who are defined from birth for limited activities, kept at home with no stimulus to grow.

In the spotlight

The media eventually cottoned onto her line of work, and she has given talks on radio and TV with advice to young people, highlighting her journey and how she got where she is. But her strength and hard work did not come without a price. She fell in love with a man and they have a child together, but she came to realise that he did not understand her, so they parted. She says that is all far behind her, and she now has a partner who supports her, loves and respects her for who and what she truly is. Irène has rebuilt everything in her life and has found happiness.

As a consulting engineer and a university graduate, and one of the institution’s success stories with a place of honour at the campus, Irène says that she never had the time to worry about what people thought about her choice of career. If she had listened to them and lost her way, she would never have been where she is today. She made her choice, took it on, and today her peers are all proud of this strong, independent woman.

When passing other people, she often hears, “She’s the girl!” A bigger accolade than that, in Irène’s mind, would be hard to find.

AFTERWORD

IFEES-GEDC SECRETARIAT

Hans Jürgen Hoyer

Secretary General

International Federation of Engineering Education Societies

Executive Secretary

Global Engineering Deans Council

On a personal note

It has been a wonderful, inspiring and creative journey working so closely with my dear colleague and friend, the African and Sudanese leader Professor Tagwa Musa, in publishing the fourth volume of the IFEEES-GEDC series *Rising to the Top*. Professor Musa is in fact the inspiration behind this entire series.

How did this come about, you may ask?

Several years ago, during my residency in East Africa, I had the opportunity to visit a then war-torn Sudan. While travelling in the region, I gained a personal insight and better understanding of the complex political, cultural and historical challenges of Sudan and its neighbouring states, and the experience moved me deeply.

Some years after my initial visit, I had the pleasure of meeting Tagwa Musa, Sudan's first and only female engineering dean. She and I connected immediately, and I encouraged her to join our Global Engineering Deans Council (GEDC), the organisation I have had the privilege to lead this past decade.

Tagwa inspired me through her vision, commitment, courage and capacity to deal with a variety of obstacles while pursuing her passion and profession. I felt that more people should have a window on the experience of women like her from around the world in the field of engineering.

I asked Tagwa to share with our global community some of her reflections about the challenges she has faced as a leader in this little-understood but special African country. She wrote a beautiful and insightful article, which

we published in our IFEEES-GEDC Global Engineering Bulletin. This article became the seed of what would become the Rising to the Top book series.

The RTTT journey begins

Tagwa's story resonated with me so powerfully that I reached out to many of my close colleagues and friends around the world and asked them if they would be willing to share their personal journeys as female engineering leaders in their respective countries. The affirmative and enthusiastic responses were overwhelming – 32 leaders from every continent agreed to share their personal and professional experiences by writing a chapter for our first volume of Rising to the Top. Of course, Tagwa's inspiring story was included.

Initial reception to our RTTT book series

Our first global volume was so well-received that we quickly decided to publish a second. I was able to engage a key global leader residing in Australia, the former WFEO president Marlene Kanga, to work closely with me on the project. Thanks to her leadership and deep connections with many leaders globally, she was able to identify and encourage a significant number of co-authors for our second volume.

We received a multitude of thoughtful responses and reflections after publishing these two volumes, and women as well as men expressed their appreciation. I also learnt that our books encouraged more men in the profession globally, and in engineering education, to seriously reflect on how they could be more effective, engaged and thoughtful in terms of supporting women in their respective leadership roles and regardless of

their cultural context.

The Africa Volume: another important step in our journey

We felt so inspired by the positive reception of our global volumes that we decided to focus more specifically on selected regions, starting with India and Africa, each of which represents diverse realities and cultures.

Volume IV focuses on the personal and professional journeys of women engineering professionals from 31 countries across the African continent. As you hopefully witnessed through engaging with these journeys, the diversity and complexity of African reality and the uniqueness of the experiences of these women co-authors are well-represented through varied narrative formats. As a collection, this book provides an inspirational insight into the lives and journeys of all authors.

I am confident that these reflections will inspire a younger generation of women leaders, not only throughout Africa's 54 countries, but also globally. Hopefully these amazing stories of journeys to success will help foster meaningful dialogue around gender parity issues in the STEM field.

Life during the Covid-19 pandemic

I am acutely aware that during the time of publishing this book in 2021, the Covid-19 crisis continues to have a devastating effect on African societies. I cannot adequately or fully express my respect and admiration for the determination of the continent's people to confront and cope with the ongoing crisis. The fact that so many women leaders have committed their time and energy during this difficult period to contribute to our volume is simply amazing and merits our deep respect.

A final word

It is my hope and expectation that there will indeed be more opportunities for all our colleagues, women and men alike, to talk openly and frankly about their own journeys, despite coming from very different backgrounds. These shared stories result in meaningful dialogue, which is a powerful way to make a real difference in this complex and evolving global environment.

I also wish to acknowledge my thoughtful, hardworking and generous colleagues who contributed to the writing, editing, design and other aspects of bringing this important book to publication. We could not have done it without you.

I feel honoured and fortunate to be able to accompany, support and learn from so many colleagues and friends on this important journey. We hope that you enjoyed reading these journeys of women leaders in Africa and that they inspire your own.

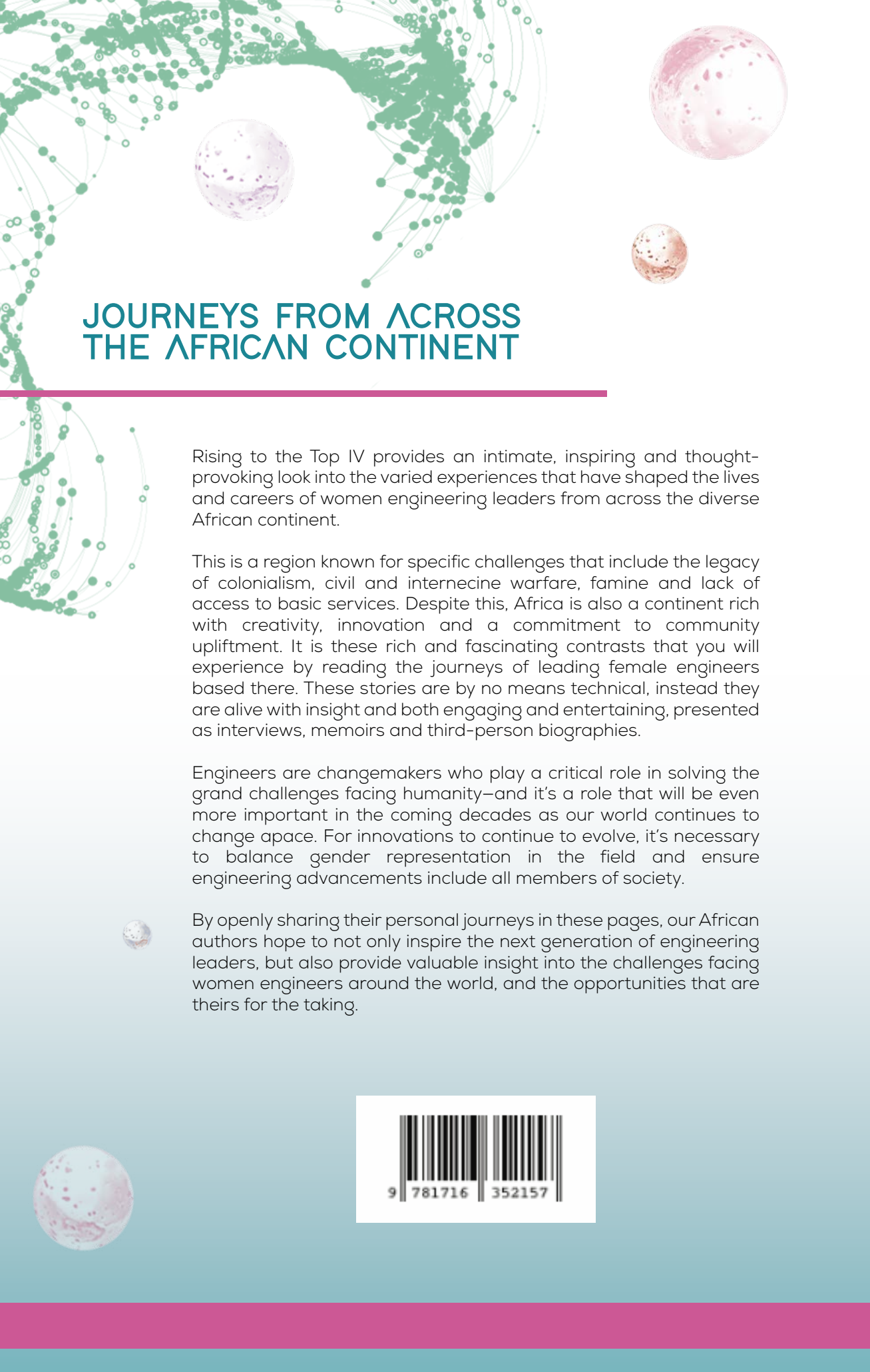
Keep rising, one and all!

Hans Jürgen Hoyer



Dr Hans Jürgen Hoyer is secretary-general of the International Federation of Engineering Education Societies (IFEES) and executive secretary of the Global Engineering Deans Council (GEDC). He is a resident scholar in global engineering at George Mason University and was also dean of the School for International Training in the United States. He is an honorary professor at education institutes in Hungary, India, Kazakhstan and Peru, an advisor to SUSTech in Shenzhen in China, and an ambassador

to Monterrey Tech in Mexico. He is a governing board member of the International Center for Engineering Education (a UNESCO organisation) at Tsinghua University in Beijing in China, serves on the board of trustees of Tishk International University in Erbil, Kurdistan (Iraq), and is an advisory board member and co-founder of the Indo-Universal Collaboration for Engineering Education.



JOURNEYS FROM ACROSS THE AFRICAN CONTINENT

Rising to the Top IV provides an intimate, inspiring and thought-provoking look into the varied experiences that have shaped the lives and careers of women engineering leaders from across the diverse African continent.

This is a region known for specific challenges that include the legacy of colonialism, civil and internecine warfare, famine and lack of access to basic services. Despite this, Africa is also a continent rich with creativity, innovation and a commitment to community upliftment. It is these rich and fascinating contrasts that you will experience by reading the journeys of leading female engineers based there. These stories are by no means technical, instead they are alive with insight and both engaging and entertaining, presented as interviews, memoirs and third-person biographies.

Engineers are changemakers who play a critical role in solving the grand challenges facing humanity—and it's a role that will be even more important in the coming decades as our world continues to change apace. For innovations to continue to evolve, it's necessary to balance gender representation in the field and ensure engineering advancements include all members of society.

By openly sharing their personal journeys in these pages, our African authors hope to not only inspire the next generation of engineering leaders, but also provide valuable insight into the challenges facing women engineers around the world, and the opportunities that are theirs for the taking.

