

## LOOKING INTO THE FUTURE:

**30 Careers in Agriculture** 

#### LOOKING INTO THE FUTURE: 30 Careers in Agriculture

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### Your one-stop agricultural career booklet



## FOREWORD

Did you know that through agricultural technology (or AgTech), there's already a career growing chicken nuggets in a laboratory?

Or that with technology, you don't need a farm to be a farmer anymore, but that you can instead farm 'vertically'?

You may have heard reference made to the Fourth Industrial Revolution (4IR). This is where the physical, digital and biological worlds come together, technologies are inter-connected, and where these technologies (think of artificial intelligence, robotics and big data) change the way we live, work and interact.

South Africans, too, have been encouraged to embrace 4IR. More than that, no matter what industry we're in, or are thinking of entering, it's likely to irrevocably shift the way the world does business. We need to keep pace as technology changes.

The agricultural sector is no different. In fact, AgTech allows the industry to farm better, smarter, more efficiently, leading to higher yields and lower costs. And it offers solutions to operating more sustainably, with better ways of farming without damaging precious natural resources.

#### As the revolution brings about considerable change in agriculture, it's also creating a wide range of new, exciting career opportunities.

Clean or cultured meat growers and vertical farmers are only two examples of emerging careers created by 4IR.

In this book, we feature writing apps for the agricultural sector, using DNA technology to catch agricultural patent thieves and many more.

For many of the careers included in this book, there are already jobs on offer, but there is a critical shortage of skills for them



in South Africa. Some of the intellige careers included, however, are in gives th their infancy (they're still in their research and development phase), his know or are slowly emerging. universi

Before long there are likely to be job opportunities available in South Africa, but you may find for now there are more jobs available internationally.

This book aims to introduce you to these careers, to give you a broad understanding of what the job entails, where you could work, and how you could potentially acquire the skills and education to do the job.

There is, however, a caveat: there is no one-size-fits-all and these are simply suggestions. During your own research, you may find other study routes that excite you more and still get you to your final destination.

For example, app developer, Jackson Dyora (featured in this book), specialises in machine learning. He therefore builds intelligent programmes which gives the machine the ability to learn. But Jackson didn't obtain his knowledge by going to university.

Rather, he taught himself to code and only later honed his skills by obtaining a tertiary education. Jackson shows us that with dedication and drive, you can reach your career goal.

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Image by: Markus Spiske

## Here's how the book hopes to help you

#### (and what homework you also need to do):



**YOU'RE INTRODUCED TO EACH CAREER.** Some are already in play; others are still emerging. But by reading this, you should understand what the day-to-day activities in a specific job could entail.



**WE PROVIDE SOME DETAIL ON WHERE YOU COULD WORK,** from the private sector, to all spheres of government. We also provide opportunities of certain jobs outside of South Africa.

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WE'VE INCLUDED A SECTION ON WHAT YOU COULD STUDY. We provide some suggestions, but there are many more study routes you can take to follow a particular career, and it's advisable to do your own research.

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**WE PROVIDE A LIST OF THE INSTITUTIONS** offering a certificate, diploma or degree to follow the proposed study route. If you choose a different path, then it's likely other tertiary institutions may also be an option for you. Again, be sure to do your own research.



**SUBJECTS AND THEMES YOU ARE LIKELY TO STUDY DIFFER BETWEEN THE VARIOUS INSTITUTIONS.** If one university or college doesn't offer the subjects you are interested in, then keep looking. There's a wide selection available.



**THE DURATION OF THE CERTIFICATE, DIPLOMA OR DEGREE ALSO DIFFERS,** depending on the qualification and the institution. We provide a guideline here.



**THE MARKS YOU NEED TO ACHIEVE IN YOUR FINAL SCHOOL EXAM** in order to study further differ from institution to institution. Once you have decided where you want to study, be sure to check their entry level requirements (which may differ from those offered in this book). This is an exciting time to enter the agricultural sector, particularly if the concepts proposed in the 4IR get your heart beating a little faster.

As we noted in our previous agricultural book, *Living Agriculture:* 50 Career Opportunities, a job can be so much more than something you do from 9 to 5.

Today employers expect hard work, commitment and a good work ethic. If you choose to work for yourself, those traits are just as essential in order to be successful. Above all, though, your career should be something you truly enjoy.

So speak to people who are already doing the job of your dreams, or to those helping to develop these emerging careers, to get to know the profession better.

For now, though, have fun with this book – as you delve into these exciting careers that are coming about as the future unfolds.



## Agricultural Al Engineering

Scarce skill in South Africa



#### What does an agricultural AI engineer do?

Al, or Artificial Intelligence, speaks to a machine's ability to mimic intelligent behaviour, by performing 'reasoning' acts. In other words, a computer can learn, perceive, plan and solve problems through Al.

Al is already used regularly in the agricultural sector, both intrnationally and in South Africa. For example, if sensors pick up that there isn't enough moisture in the soil, the Al system can react, and turn on the irrigation system until there is enough moisture. Or the Al system could tell a robot to tell the difference between ripe fruit versus those that aren't ripe. An Al engineer creates, updates and maintains these Al systems. As smart and precision farming become more commonplace, the role of the agricultural Al engineer will become increasingly prominent in the sector.

#### Where could you work?

Currently, AI engineers working in agriculture are most likely to work for a company that builds next-generation machines, which farmers then use to farm more efficiently. There are also opportunities working for research and academic institutions, and in some instances, for relevant government departments. An engineer would most probably work as part of a larger team of people, each with their own speciality.

Once you have training in AI engineering and an agricultural field of your choice, you may be able to work independently or start your own company. While South Africa is rapidly embracing the Fourth Industrial Revolution, there will also be many opportunities in other countries that are revolutionising their agricultural sector.

#### What could you study?

To become an agricultural AI engineer, it would make sense to first study a higher diploma, degree or course related to computer science, specialising in AI at a postgraduate level. These skills can then be applied to the agricultural sector.

#### Where could you study?

These institutions could provide you with a diploma or degree with a focus on computer science.

- Cape Peninsula University of Technology
- Central University of Technology, Free State
- Durban University of Technology
- Mangosuthu University of Technology
- Nelson Mandela University
- North West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Limpopo
- University of the Western Cape
- University of Pretoria
- University of South Africa
- University of the Free State
- University of Venda
- University of Witwatersrand
- University of Zululand



## What subjects and themes are you likely to study?

This varies from institution to institution but could include computer science, programming, algebra, calculus and real analysis.

## What's the duration of the certificate/diploma/ degree?

A bachelor's degree could be a three or four-year programme, depending on the course and institution you choose.

## General entry-level requirements to study to become an agricultural AI engineer?

English	:	4 (50-59%)
Mathematics	:	3 (40-49%)
Mathematics Literature	:	5 (60-69%)
Technical Maths	:	4 (50-59%)



# Agricultural App Developer

Scarce skill in South Africa

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Image by: Jakob Rosen



#### What does an agricultural app developer do?

An app developer is a software engineer who creates, tests and programme applications for computers, mobile phones and tablets. Apps give farmers and others involved in agriculture a quicker, better and more intuitive way to manage their business.

For example, apps can help farmers control water budgets, be warned of extreme weather and increase crop yields by identifying problems. An agricultural app developer would firsty need to understand the problem, and then build the computer or smartphone software to solve the problem.

#### Where could you work?

As a developer you could be directly tasked with programming the app, troubleshooting or debugging, or be responsible for the aesthetic "feel" of the app. An agricultural app developer could work alone in a freelance position or as part of a team of creatives, engineers and industry specialists developing apps across a wide range of sectors. There are prospects, therefore, working for tech start-ups, IT companies, research institutions, government departments and even the non-profit sector.

#### What could you study?

A bachelor's degree, majoring in computer science could be beneficial. Alternatively, consider a higher certificate or diploma (also in computer science or information technology) to get your first steps in this career, with opportunities to then study further.

#### Where could you study?

These institutions could provide you with a diploma or degree with a focus on computer science.

- Boland College
- Buffalo City TVET College
- Cape Peninsula University of Technology
- Capricorn TVET College
- Central Johannesburg TVET College
- Central University of Technology, Free State
- Coastal KZN TVET College
- College of Cape Town
- Durban University of Technology
- Eastcape Midlands TVET College
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- False Bay TVET College
- Goldfields TVET College
- Ikhala TVET College
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Mangosuthu University of Technology
- Mnambithi TVET College
- Mopani South East TVET College
- Nelson Mandela University
- Nkangala TVET College
- North West University
- Northern Cape Urban TVET College
- Port Elizabeth TVET College
- Rhodes University
- Sekhukhune TVET College
- South West Gauteng TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane South TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg

- University of KwaZulu-Natal
- University of Limpopo
- University of Mpumalanga
- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

### What subjects and themes are you likely to study?

Subjects and themes could include applications development foundations, ICT fundamentals, programming; and in later years applications development practice and theory, and information management.

### What's the duration of the certificate/diploma/ degree?

A diploma or degree is likely to be a three or four-year programme, depending on your institution of choice.

### General entry level requirements to study to become an agricultural app developer?

#### For a degree or diploma :

English	:	4 (50-59%)
Mathematics	:	3 (40-49%)
Mathematics Literature	:	5 (60-69%)
Technical Maths	:	4 (50-59%)



**JACKSON DYORA** App Developer

## How this self-taught app developer is helping emerging farmers

It's helpful to study Computer Science in order to become a software developer and machine learning expert. But for Jackson Dyora, co-founder of Khula Agriculture Technology, most of what he knows today is self-taught.

Jackson is the technical expertise behind Khula, an agricultural app that connects farmers to markets in the formal marketplace. The app, which focuses on helping small and emerging farmers, won the MTN Business App of the Year in 2018.

He says: "No one taught me how to code – I'm self-taught. I wrote my first app when I was second year at varsity." In fact, he first chose to study civil engineering. But a lack of finances put his plans on hold. So instead of studying immediately after school, Jackson and his father spent a year raising the funds he needed to attend Wits University. "During that time, I started coding – and loved it. So when I went to varsity a year later (in 2014), I chose to do Computer Science."

#### It's all about "problem solving"

Today, Jackson serves as the Chief Technical Officer at Khula. He says: "My main role is to deal with the technical aspects at Khula. I focus on product integrity, to make sure the app is working correctly, and I address any issues that require follow-up and bugs that may come in." He is also studying a Master's in Computer Applications, specialising in Robotics, in his spare time.

Working as an app developer – especially in your own business – is hard work. Jackson is up at 4am every day to start coding on the Khula app. He meets daily with one of his co-founders, Matthew Piper, to plan the app's development. He also meets with partners, including banks and other stakeholders that the company works with. Towards the end of the day, Jackson makes himself available to his team of developers, to help "lend a hand" where it's needed.

He doesn't believe one needs to be a computer whizz to do what he does. "It's not about writing code. In fact, writing code is about 10% of the work. The biggest part is solving problems. I like solving problems, like puzzles. If you have mathematics as a base, you're logical, and you're a problem solver, then this career could be ideal for you." He adds: "It's not about hard work; it's about smart work."

#### Finding the gaps in agriculture

There's another reason Jackson believes in this career. "The gaps in the agricultural sector (in terms of technical expertise and development) are eye-opening." For example, Khula is working on becoming a cryptocurrency player in the agricultural sector – offering a cryptocurrency 'platform' to farmers. This will remove the red tape and restrictions that accompany traditional finance.

His skills also go beyond app development. Jackson's first love is machine learning. Currently he is writing machine learning code that will calculate the daily average price on a range of farming products, based on average price trends.

But in the short term, for this 27-year old computer genius and his Khula counterparts, the plan is to use the app to expand across South Africa, and even into Africa. "We want to help improve the way farmers do business, and help increase profits, especially for emerging farmers."

## Agricultural Assurance Specialist

Scarce skill in South Africa

Image by: Gabriel Jimenez

#### What does an agricultural assurance specialist do?

Farmers and agricultural companies sell products to the market, i.e. wine, cut flowers and fruit. But consumers want to know that the product they're buying hasn't damaged the environment, nor been produced unethically. An agricultural assurance specialist provides this service:

To help these producers and companies meet market and legislative requirements, such as care for the environment, and meeting labour laws. Think of an organisation such as Fair Trade or the Sustainability Initiative of South Africa (SIZA), and the role they play in supporting sustainable practices. This role could be a supportive role, where the specialist helps producers and small businesses to improve practices over time. Or it could be an audit-based role, where the specialist audits the producer, to see where they meet the market and regulatory requirements, and where they may fall short. Given the increasing call from consumers for businesses to operate ethically, the role of the assurance specialist has never been more important.

#### Where could you work?

Non-profit organisations, non-profit companies and audit companies employ agricultural assurance specialists to help farmers and businesses meet market and regulatory requirements. Many larger companies also employ assurance specialists internally, to ensure the business operates ethically across the supply chain. There are opportunities in South Africa, as well as in Africa, and internationally. Take note, though: the assurance specialist would need to be up to date on the regulatory requirements of the country in which he or she works, with each country adopting a unique set of laws.

#### What could you study?

A social auditor should ideally have a tertiary qualification, and it may be advisable to investigate a degree in social sciences or a law degree.

#### Where could you study?

- Cape Peninsula University of Technology
- Nelson Mandela University
- North West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Fort Hare
- University of KwaZulu-Natal
- University of Mpumalanga
- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Witwatersrand
- University of Zululand

#### What subjects and themes are you likely to study?

The modules you will study depend on the institution you attend but could include legal skills, introduction to law, psychology, Constitutional law, legal interpretation, labour law and labour economics.

## What's the duration of the certificate/diploma/ degree?

This depends on your institution of choice. A Bachelor of Arts (Law) is a three-year programme with most institutions.

## General entry level requirements to study to become an agricultural assurance specialist?

English	:	4 (50-59%)
Mathematics	:	3 (40-49%)
Mathematics Literature	:	4 (50-59%)
And another official language	:	4 (50-59%)



**KATHY O'GRADY** Assurance specialist

### Helping businesses become more sustainable for a better world

An assurance specialist should ideally have two important traits: the ability to listen and to communicate well, says Kathy O'Grady, an assurance specialist working in South Africa and across Africa.

Kathy has worked in the field of assurance for most of her career. She undertakes social audits of producers (such as farmers) or companies, to see whether they meet market requirements. She also trains producers and companies to meet market standards and the laws of a country.

"The role is about sustainability," she says. "We help business apply sustainable practices, covering both the environment and fair labour practice. It's to support stakeholders to have these sustainable systems in place and to manage how they meet these principles."

#### South Africa's growing focus on assurance

Most agricultural industries in some way affect the environment and employ a team of people to work for them. But the consumers who buy the farmer's product (such as wine and fruit) want to know that the business operates ethically. "Most of the trust around assurance comes from overseas markets, such as the European Union and the United Kingdom, but the focus is also growing in South Africa and Africa," she says. Kathy obtained her tertiary education at the University of Stellenbosch, studying a BA Sociology degree. After that, she worked as a paralegal for a law firm that supported communities who didn't have access to legal assistance. "This career set the scene for me, giving me legal exposure in terms of human rights." Since then, Kathy has worked across many industries – including the agricultural sector – helping businesses become increasingly sustainable, and be in a position to provide evidence of this. She now works at Partner Africa, a non-profit organisation which audits and helps advise businesses to operate responsibly.

The job allows her to travel across the continent, meet people and hear their stories. "For me, it's humbling having the opportunity to meet people across Africa and learn more about them. As an assurance specialist, it's so important to acknowledge people, and open ourselves up to listen to them and hear their stories. It's amazing to get an insight into their lives."

She also enjoys seeing the positive results of the work. "When you see the evidence of a shift in mindset, in the way people see things, and become more open to hearing different sides of the story, it's also very rewarding."

#### "Listen with an open mind"

Kathy recommends aspiring assurance specialists obtain a social sciences or law degree. "You should have an understanding of the socio-economic, political and agricultural context of the country. And you should have a strong interest in the legal system, because that's the framework in which you'll work."

Sustainability is a buzzword of the Fourth Industrial Revolution. So it's no wonder this profession is gaining prominence. Kathy says, "Unless we apply sustainable business practices and live these every day, both in terms of fair labour and the environment, then a business simply isn't sustainable. It's the realisation that the way you treat people and the environment is such an integral part of any business and it must be taken seriously. That's the most important part of assurance."

## Agricultural big Data Analyst

**Emerging skill in South Africa** 

Image by: Jordan Whitfield

## What does an agriculture big data analyst do?

Farmers and others working in the agriculture industry can – thanks to great advances in technology – make use of masses of data that can help them farm better and smarter.

New tech allows analysts to collect data on the weather, crops, animals and even international markets, to name a few examples. But how can one use these massive datasets? That's where the agriculture big data analyst comes in: he or she specialises in analysing and presenting these large, and often extremely complicated datasets. The goal could be to help a farmer optimise practices, reduce risk and increase profit. Or the analyst could micromanage smaller parts of the business, such as weather patterns to find the best time to activate pest management or to plant crops.

#### Where could you work?

Analysts often work for agricultural production companies, helping them to introduce and manage applications that collect the data and then make sense of the data. Research institutions, academia or even government departments could require these skills. But there are also opportunities for self-employment (once you have built up enough experience in the sector). While this is still an emerging career in South Africa, agriculture big data analysts are often in demand internationally.

#### What could you study?

To become a big data analyst, you are likely to need a diploma or degree in mathematics, statistics, information technology or information management, or subjects that build analytical and statistical skills.

#### Where could you study?

These institutions offer national certificates, diplomas or a bachelor's degree with a focus on computer science, information technology, mathematics or statistics. Further study may be appropriate if you have completed your national certificate.

- Boland College
- Buffalo City TVET College
- Cape Peninsula University of Technology
- Capricorn TVET College
- Central Johannesburg TVET College
- Coastal KZN TVET College
- College of Cape Town
- Eastcape Midlands TVET College
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- False Bay TVET College
- Goldfields TVET College
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- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Mnambithi TVET College
- Mopani South East TVET College
- Nkangala TVET College
- North West University
- Northern Cape Urban TVET College
- Port Elizabeth TVET College
- Rhodes University
- Sekhukhune TVET College
- South West Gauteng TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane South TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg

- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

## What subjects and themes are you likely to study?

Computer skills, mathematics, statistics, data management and programming could be subjects you'd study.

## What's the duration of the certificate/diploma/ degree?

A national certificate (vocational) is a one-year programme with many institutions, while a diploma or degree could be between three and four years, depending on your institution of choice.

## General entry level requirements to study to become an agricultural big data analyst?

English	:	4 (50-59%)
Mathematics	:	4 (50-59%)
Physical Sciences	:	4 (50-59%)
And Business Studies	:	4 (50-59%)
Or Economics	:	4 (50-59%)
Or Accounting	:	4 (50-59%)

## Agricultural Blockchain Assurance expert

\$1,672.60

Stats

TODAY'S VOLUME

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**Emerging skill in South Africa** 

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Image by: Austin Distel

### What does an agriculture blockchain assurance expert do?

You may have heard of Bitcoin – a cryptocurrency (or a virtual currency) that uses digital files as money. The record-keeping technology behind Bitcoin is something called blockchain.

Blockchain allows peer-to-peer (person-to-person) transactions to take place without the need of a middleman (think of the role a bank or other intermediary can play). Because blockchain is a database that's shared across a network of computers (a decentralised ledger) it's very difficult to edit, change, or forge – and it allows transactions to take place immediately. And that potentially makes blockchain a good tool to use in the agriculture sector, especially to track agricultural products, so that retailers and consumers can see where the food or products they're buying originate from, for total transparency, and therefore to help cut risks of foodborne diseases.

Traceability blockchain systems are already in place in the food sector in countries such as America and Canada. Blockchain assurance experts would work with farmers, small businesses and others in the sector to address risk management, such as risk assurance of blockchain infrastructure, to ensure the proper controls are in place.

#### Where could you work?

This career is still in its development phase. Currently, some South African and international auditing firms are appointing blockchain assurance experts, to engage with clients in the blockchain and crypto-asset space, and to increase the trust and transparency of this technology as a solution. Other tech-based companies are helping businesses develop their own blockchain solutions. This career is therefore not commonly available yet – certainly not in the agriculture space, although interest is growing as the public and private sector embrace the Fourth Industrial Revolution.

#### What could you study?

Currently, most companies requiring these services appoint individuals with a university degree in IT or an IT-related field.

#### Where could you study?

- Cape Peninsula University of Technology
- North West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand

## What subjects and themes are you likely to study?

Business management, computer science, mathematics, quality inspection, auditing and quality testing could be some of the subjects and themes, depending on your institution of choice.

## What's the duration of the certificate/diploma/ degree?

A bachelor's degree in an IT-related field could be a three or fouryear programme.

## General entry level requirements to study to become an agricultural blockchain assurance expert?

English	:	4 (50-59%)
Mathematics	:	4 (50-59%)
Physical Sciences	:	4 (50-59%)
And Business Studies	:	4 (50-59%)
Or Economics	:	4 (50-59%)
Or Accounting	:	4 (50-59%)

## Agricultural ••• Cryptocurrency Financier

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Emerging skill in South Africa



### What does an agriculture cryptocurrency financier do?

In the traditional sense, financiers are middlemen (or women): They pool money from those who have it and want to lend it to get the highest return possible, and they distribute the money to those who need it. An agriculture cryptocurrency financier plays the same role but would operate in the agriculture sector, and work with cryptocurrency (like Bitcoin) rather than traditional money.

The cryptocurrency financier and the partners involved benefit from real-time transactions and financing, transparency, and lower transaction fees. He or she could fund elements such as agribusiness development, value chain development or agricultural production – or wherever financing is needed.

#### Where could you work?

This space is still emerging in South Africa, although several there are a number of blockchain enterprises in America, Europe and Asia that are supporting cryptocurrency financing in the agricultural sector, where career opportunities could exist. The size of the global blockchain in agriculture and the food supply chain is expected to increase nearly tenfold in the next five years, leading to a potential increase in financing opportunities in the near future.

#### What could you study?

A background in finance or commerce, or even financial mathematics could serve as a good foundation to further this career. As such, a bachelor's degree in finance or commerce, with a good understanding of blockchain, cryptocurrencies and fintech could be helpful.

#### Where could you study?

- Cape Peninsula University of Technology
- North-West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
You could study subjects such as business management, micro and macro-economics, accounting, business statistics and foundation accounting.

## What's the duration of the certificate/diploma/ degree?

A Bachelor of Commerce is a three or four-year programme, depending on the course and institution you choose.

## General entry level requirements to study to become an agricultural cryptocurrency financier?

Mathematics	:	5 (60-69%)
English	:	4 (50-59%)



# Agricultural Cybersecurity Specialist

Scarce skill in South Africa

Image by: Jefferson Santos

### What does an agriculture cybersecurity specialist do?

The future of a strong and successful agricultural sector (from the farm to agriculture companies and even agricultural departments within government) relies on the use of technology.

Think of precision or smart farming, the use of robotics and machine learning - which help the sector operate better. But these systems make use of hardware and software that could be vulnerable to malicious or targeted cyber attacks, theft or ransom. The agriculture cybersecurity specialist must prevent this from happening - searching for vulnerabilities in a system during the development phase and once the system is in use. This specialist must also manage any attacks, to minimise loss and damage.

#### Where could you work?

Cybersecurity professionals could work in nearly every sector: public and private, for-profit and non-profit, and research and academia; and in a variety of different roles including application security, data loss prevention, forensics, incident response, network security, security architecture, threat intelligence and vulnerability management. This career is sought-after internationally, as well as in South Africa, where there is a critical shortage of skills currently.

#### What could you study?

It may be advisable to obtain a bachelor's degree in computer science, information technology or a related field, although it's worth noting that there are online short courses available in cybersecurity. We've also included TVET colleges that provide further studies in computer science and information technology.

#### Where could you study?

- Boland College
- Buffalo City TVET College
- Cape Peninsula University of Technology
- Capricorn TVET College
- Central Johannesburg TVET College
- Central University of Technology, Free State
- Coastal KZN TVET College
- College of Cape Town
- Durban University of Technology
- Eastcape Midlands TVET College
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- False Bay TVET College
- Goldfields TVET College
- Ikhala TVET College
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Mangosuthu University of Technology
- Mnambithi TVET College
- Mopani South East TVET College
- Nelson Mandela University
- Nkangala TVET College
- North West University
- Northern Cape Urban TVET College
- Port Elizabeth TVET College
- Rhodes University
- Sekhukhune TVET College
- South West Gauteng TVET College
- Taletso TVET College
- Tshwane North TVET College
- Tshwane South TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Limpopo
- University of Pretoria
- University of South Africa





- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

Subjects could include personal data security, wireless security, public-key encryption, digital signatures, computer crime and digital evidence. A general computer science degree might not include this level of detail, rather focusing on the introduction to computer science, mathematics, data structures and algorithms, and computer architecture.

### What's the duration of the certificate/diploma/ degree?

A national certificate (vocational) is a one-year programme. A diploma is a three-year programme and a bachelor's degree could be a four-year programme, depending on your institution of choice.

### General entry level requirements to study to become an agricultural cybersecurity specialist?

First Language	:	4 (50-59%)
Mathematics	:	6 (70-79%)
Physical Sciences	:	4 (50-59%)
Or another approved subject	:	4 (50-59%)

## Agricultural Data integration Developer/ manager

Scarce skill in South Africa

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Item 2

Image by: Adeolu Eletu



### What does an agriculture data integration developer/manager do?

Data is the currency of our generation. It is being created constantly. But raw data is useless. A data integration developer and manager analyses and manages information. An integration developer has to consolidate the data from a wide variety of sources into a single dataset and does this by creating the software for an automated data integration process.

In agriculture, a developer could integrate huge amounts of data that has been collected such as pricing models or weather statistics and could determine patterns using this data. The job would likely entail validating the data, integration, analysing it, data cleansing and compiling data reports.

#### Where could you work?

Agricultural medium to larger organisations could require data integration developers, to support clients like farmers to combine and make sense of data. Currently, though, this career is perhaps more entrenched in IT organisations, which who would work with clients in the agricultural sector (and other sectors too). Research and tertiary institutions, non-profits and government departments using raw data to support agriculture could also employ these developers. Opportunities exist locally and abroad.

#### What could you study?

Many employers employ data integration developers who have a national diploma or university degree in computer science, information systems or software engineering. We have also included those colleges that provide a national certificate in computer science and information technology, which could serve as a stepping stone to further study.

#### Where could you study?

- Boland College
- Buffalo City TVET College
- Cape Peninsula University of Technology
- Capricorn TVET College
- Central Johannesburg TVET College
- Coastal KZN TVET College
- College of Cape Town
- Eastcape Midlands TVET College
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- False Bay TVET College
- Goldfields TVET College
- Ikhala TVET College
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Mnambithi TVET College
- Mopani South East TVET College
- Nkangala TVET College
- North West University
- Northern Cape Urban TVET College
- Port Elizabeth TVET College
- Rhodes University
- Sekhukhune TVET College
- South West Gauteng TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane South TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of Pretoria
- University of South Africa
- University of the Free State

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- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

Subjects could include data engineering, strategic information systems, information and technology management and technology management.

### What's the duration of the certificate/diploma/ degree?

An appropriate degree, such as a BSc in Business Analytics is a four-year programme. If you choose to obtain an entry-level national certificate (vocational) in Computer Science, this could be a one-year qualification.

### General entry level requirements to study to become an agricultural data integration developer/manager?

For a diploma or a degree		:
English	:	4 (50-59%)
Mathematics	:	4 (50-59%)
Physical Sciences	:	4 (50-59%)
And Business Studies	:	4 (50-59%)
Or Economics	:	4 (50-59%)
Or Accounting	:	4 (50-59%)

# Agricultural DNA fingerprint Researcher

Scarce skill in South Africa



### What does an agricultural DNA fingerprinting researcher do?

DNA fingerprinting is the test researchers do to see the genetic makeup of a person or any other living thing. All living things are made up of cells, which in turn contain chromosomes and genes. And genes hold the information that determines the traits of the being (for example, having curly or straight hair).

In practice, DNA fingerprinting is used in the police service, to connect evidence or a person to a crime scene. Or it can show who your parents or other relatives are. DNA fingerprinting has the same applications in agriculture, such as genetic mapping, and genetic diversity studies. Researchers can, for example, look at the DNA of fruit, to see what agronomic traits it will have, whether it will be disease-resistant, and even whether it is a patented varietal (of fruit or grapes) that has been used without the necessary permission.

#### Where could you work?

DNA fingerprinting researchers are lab-based, working at laboratories at research institutions such as the Agricultural Research Council, or at tertiary institutions. Some private agricultural companies employ these researchers to support their ongoing research. This scarce skill is also sought-after internationally.



#### What could you study?

A Bachelor of Science degree could serve as a good foundation, preferably majoring in genetics. It could be helpful to include subjects such as bioinformatic science, molecular biology and biotechnology. However, a master's or PhD degree could be recommended for those wishing to advance in their careers, or those undertaking independent research.

#### Where could you study?

- Cape Peninsula University of Technology
- Stellenbosch University
- University of Cape Town
- University of Pretoria
- University of the Free State
- University of the Western Cape
- University of Witwatersrand
- University of Zululand





Subjects could include an introduction to genetics, cell biology, chemistry, mathematics, gene regulation and cell signalling.

### What's the duration of the certificate/diploma/ degree?

Should you study a Bachelor of Science with Genetics as a major, it could be a three-year programme.

### General entry level requirements to study to become an agriculture DNA fingerprint researcher?

Mathematics	:	6 (70-79%)
Physical Sciences	:	5 (60-69%)



**SIEYAAM SAFODIEN** Molecular biologist

### New discoveries and catching crooks: How DNA fingerprinting aids agriculture

Molecular biologist, Sieyaam Safodien, loves making new discoveries. "The most rewarding part of my job is finding out new things that no one has found before, such as characterising a disease for the first time. Or finding a particular trait to help a plant grow better."

Sieyaam works as a researcher for the Agricultural Research Council. Her job entails undertaking agricultural DNA fingerprinting. She laughs at any reference to those crime shows on television that made DNA fingerprinting famous. "But the basic principles that apply to humans also apply to other living things," she says. "We can determine, by using molecular data, who your parents are. And we can apply this to plants, to determine the genetics that control the plant's characteristics."

As a researcher, she works with plant breeders to help them develop new cultivars. "In the past, breeders had to wait for years to see whether the tree or plant they crossed will have the traits they want. Now we can look at a molecular level and immediately see what traits the tree will have."

Sieyaam also helps to prevent the unauthorised use of patented varietals. She has created a DNA database of all fruit varietals. And she uses this database to distinguish patented varietals from those created and used illegally. "As an example, you get different kinds of apples, such as golden delicious apples, and each kind has its own unique fingerprint. So if someone has a

query, we can do varietal identification, and tell you whether your plant has been stolen." This also means that Sieyaam, who works in a laboratory in Stellenbosch, sometimes has to testify in a court of law.

#### **Communication is key**

That's one of the reasons researchers working in this field must have good communication skills. But scientists also have to communicate with their peers, and often meet and work with farmers. "That means you must be able to speak to different people at their level of knowledge, so that you can find a meeting point to understand them, and they can understand you." The writing skills of researchers should be excellent, given the number of academic papers they write. "And you must have a thick skin," she says. "Your work is peer-reviewed and criticised and you must be able to handle this."

She completed her undergraduate BSc degree, majoring in biochemistry and microbiology, and then completed her honour's in environmental microbiology at the University of the Western Cape. Her master's in plant pathology at Stellenbosch University allowed her to apply molecular biology to plant pathology, such as studying disease in grape vines.

She recommends young scientists entering this field to consider majoring in genetics, but to include subjects such as bioinformatics and computational biology where possible. "For future young scientists, these subjects will help you make sense of the data. The use of computers to analyse data is the way science is going. I had to teach myself to do this." She also suggests completing a postgraduate degree and even completing a post-doctorate fellowship at an international university.

Even if you choose not to spend time at an overseas university, know that as a scientist, you'll never stop learning. Sieyaam says: "Science changes so quickly and you have to stay abreast of these changes. I'm still learning, despite decades working in the field. In fact, there's no time when I'm not learning."

# Agricultural Drone Operator

Scarce skill in South Africa

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Image by: Ryan Searle



#### What does a drone operator do?

Drones have revolutionised many different sectors, not least agriculture. A drone operator steers the drone, which is used to collect data (such as photos or imagery) to help understand and monitor what's happening on a farm. Drones can track livestock, and even monitor their growth.

They can monitor a crop and can tell the farmer whether plants are healthy, or not. They're used to facilitate fertilising a crop, or the introduction of pest control programmes, and can assess damage from storms or fires, helping farmers to put risk management plans in place.

#### Where could you work?

Drones are becoming increasingly essential to farm management. Many farmers may make use of their own drones, but others rely on agricultural companies that they contract to help collect the data. Drone operators could ply their trade working for an agricultural for-profit company, or an agricultural research institution.

Non-profit organisations may make use of drone operators (for example, Fire Protection Associations could use drones to assess a burn scar). And there are opportunities within government departments and conservation authorities for drone operators.



#### What could you study?

If you fly drones commercially, you do need to obtain a licence from anyone from several aviation training schools. (You also need to ensure your drone is registered by the South African Civil Aviation Authority). It could also make sense to have a background in agriculture, such as a diploma or degree, or a qualification linked to Geographic Information systems, or GIS.

#### Where could you study?

The following organisations are listed as approved training organisations on the South African Civil Aviation Authority's website (SACAA). There may be more training organisations available – but it may be best to check that they are approved by the SACAA.

- Cortac
- Cranfield Aviation Training
- Drone iT
- Drone Safety and Legal (DSL)
- Heli-X Charters
- ProWings
- RPAS Training Academy
- UAV Industries Flight School

Aviation training schools are likely to cover meteorology, radio links, air law, navigation and flight planning, principles of flight and human factors.

### What's the duration of the certificate/diploma/ degree?

The course contains a theory and practical element. While the theoretical course could be a week (depending on the company you choose to use), the practical element depends on your skill level.

### General entry level requirements to study to become an agricultural drone operator?

English Proficiency Test Level 4 or higher Applicants must be 18 years or older Applicants must possess a valid Class 3 Medical Certificate

## Agricultural Drone Engineer

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Scarce skill in South Africa



### What does an agricultural drone engineer do?

A drone engineer is responsible for the ongoing development of drone technology. An engineer might take cues from existing engineering (like working to reduce the noise level of the drones we use now) or develop new types of drone (think of drones that operate on the water with fins or propellors, or at ground level across a tricky terrain or inside dense crop plantings). A drone engineer would likely need to have a background in electrical, mechanical, or robotics engineering, and an expert understanding of camera technologies, Global Navigation Satellite System (GNSS), Global Positioning System (GPS) and an open mind to new ideas.

#### Where could you work?

Many industries use drones, including aircraft manufacturers, engineering and construction companies and companies working in agriculture and forestry. Innovation departments at tertiary institutions could also be looking at drone engineering. Within the agriculture sector, there could be opportunities to develop drones with your own start-up company. You may work alone or with a team of specialists, and there are employment prospects globally for drone engineers.

#### What could you study?

It could make sense to consider a degree for this career, particularly with a focus on electrical, mechanical, or robotics engineering (consider a Bachelor of Engineering Technology). Drone pilot certification (see agricultural drone operator) could also be beneficial.

#### Where could you study?

- Cape Peninsula University of Technology
- Central University of Technology, Free State
- Durban University of Technology
- Mangosuthu University of Technology
- Nelson Mandela University
- North-West University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Pretoria
- University of South Africa
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand

Subjects and themes could include engineering mathematics, digital electronics, engineering programming, electrical technology and engineering mathematics.

### What's the duration of the certificate/diploma/ degree?

A diploma is a two-year programme, while a bachelor's degree is likely to be a three-year programme, depending on your institution of choice.

### General entry level requirements to study to become an agricultural drone engineer?

Mathematics	:	4 (50-59%)
Physical Sciences	:	4 (50-59%)
English	:	4 (50-59%)



## Agricultural Drone Maintenance Repair technician

Scarce skill in South Africa

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### What does an agricultural drone maintenance/repair technician do?

A drone maintenance/repair technician would be responsible for maintaining and fixing drones. You are likely to need knowledge of electronics and engineering. The job could entail replacing parts before they wear out, or those that have broken, software and hardware debugging, and troubleshooting. You should also have a good understanding of operating software and systems (given that drones are usually synced with smartphones), and how to correctly run updates, or reformat or reinstall the software. You are also likely to maintain service records for clients.

#### Where could you work?

A drone maintenance/repair technician could be employed in technology companies or manufacturing outfits that support the agricultural sector as well as other industries. There are opportunities to freelance as a maintenance or repair technician or start your own business fixing drones. As drones have become increasingly popular in South Africa, the career opportunities for these technicians have increased – although they are unlikely to be focused solely on the agricultural sector at this stage.

#### What could you study?

There are many courses available to better understand how to maintain and repair a drone. However, some employers may prefer to employ a technician with a national certificate, degree or diploma, such as a bachelor's degree in electrical engineering.



#### Where could you study?

- Boland College
- Cape Peninsula University of Technology
- Capricorn TVET College
- Central Johannesburg TVET College
- Central University of Technology, Free State
- Coastal KZN TVET College
- College of Cape Town
- Durban University of Technology
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- Esayidi TVET College
- False Bay TVET College
- Gert Sibande TVET College
- Goldfields TVET College
- King Sabata Dalindyebo TVET College
- Lephalale TVET College
- Majuba TVET College
- Maluti TVET College
- Mangosuthu University of Technology
- Mnambithi TVET College
- Mthashana TVET College
- Nelson Mandela University
- Nkangala TVET College
- North-West University
- Northern Cape Rural TVET College
- Port Elizabeth TVET College
- Sekhukhune TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Pretoria



- University of South Africa
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

Should you opt for an electrical engineering background, you could study subjects such as electronics, electrical engineering, engineering mathematics, power systems, microprocessors and software development.

## What's the duration of the certificate/diploma/ degree?

A national certificate could be a one-year qualification, while a diploma could be a two-year programme, and a bachelor's degree a three-year programme, depending on your institution of choice.

### General entry level requirements to study to become an agricultural drone maintenance/ repair technician?

For a diploma or a degree		:
English	:	4 (50-59%)
Mathematics	:	4 (50-59%)
Physical Sciences	:	4 (50-59%)
Technical Mathematics	:	5 (60-69%)
Physical Science	:	4 (50-59%)
Technical Science	:	5 (60-69%)

## Agricultural Food Printing Operator

Sca<mark>rce skill</mark> in South Africa

#### What does an agriculture food printing operator do?

Printing food may sound odd, but it's rather simple. New technology allows people to print food, by designing and inputting the 'recipe' into software, and then printing the food. This is usually done by food-grade syringes that build the food layer by layer, cooking the food at the same time (using lasers). In its simplest form, think of a food grade syringe 'printing' tomato sauce onto a pizza base.

This technology gives food companies the ability to manufacture food too much more precise sizes and weights than in the past, in much more complex ways. For example, food printing could manufacture a food pellet for an animal to a certain shape or size without the need for expensive moulds or dies. A food printing operator will operate the printer, working with the software to print the final product, oversee the equipment to ensure it's running smoothly, as well as troubleshoot should there be any problems. Food safety is crucial, and the operator must ensure food safety throughout the process.

#### Where could you work?

An operator could work for a food company or food design agency in many different parts of the manufacturing process, and in different sectors of the food industry, such as animal feeds. This is still a relatively new technology (especially in South Africa), and research is ongoing – therefore there are also opportunities within research institutions and at academic institutions (in South Africa and internationally).

### What could you study?

To operate the printer, a degree or course in a relevant engineering field could support your career development. Or should your focus be on food safety, then a food science or food technology degree or diploma could offer a good foundation.

#### Where could you study?

- Cape Peninsula University of Technology
- Durban University of Technology
- Tshwane University of Technology
- University of Johannesburg
- University of Pretoria
- University of Stellenbosch
- University of the Free State
- University of Venda





Should you choose a food science of food technology foundation for this career, subjects could include food technology, chemistry, biology, mathematics, biometrics, food manufacturing, quality assurance, and food analysis.

### What's the duration of the certificate/diploma/ degree?

A diploma could be three years, and a degree in food science could be a four-year programme, depending on your institution of choice.

### General entry level requirements to study to become an agricultural food printing operator?

English	:	4 (50-59%)
Mathematics	:	4 (50-59%)
Life Sciences	:	4 (50-59%)
Physical Science	:	4 (50-59%)

## Agricultural in-field 3D Printer operator

**Emerging skill in South Africa** 

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### What does an agricultural in-field 3D printer operator do

3D printing, also known as additive manufacturing, is a method of creating a product by uploading a three-dimensional design to a computer and then printing it by building the object layer by layer. Products that can be modelled in 3D, and are made of plastics or metals (and as we note in the career as a food printing operator, even organic matter) can be created by these printers.

3D printers can be portable. That's why they are ideally suited to fix equipment in the field – a great benefit for farmers who are based in remote areas. Printing the product in the field, therefore, reduces time and cost. An in-field operator is responsible for printing the parts and maintaining the printer. The operator can store a full inventory of parts digitally that are ready to be printed at any time. This will also be useful when products or objects aren't in regular production anymore (such as older equipment). (3D printing operators should prepare themselves so long for 4D printing, which includes printing a fourth dimension: movement).

#### Where could you work?

Printing in the field is very much an emerging career. To date, 3D printing operators have worked broadly across many sectors (not only agriculture). But as experts develop cheaper 3D printers that can print metal, in time this career could become focused on agriculture.

An operator could work for equipment manufacturers, engineering companies or companies that print parts for agricultural machinery. In fact, any agricultural industry where open-source designs are available can use 3D printing (think of a sector such as hydroponics, where 3D printing is already used extensively). Many people have started their own 3D printing and operating business.

#### What could you study?

Depending on the field you plan to work in, you could look at a certificate, diploma or degree in computer science, mechanics or engineering (or mechanical engineering). However, there are also many training courses on 3D technology that are helpful. Consider completing a course in Computer-Aided Design (CAD) software, an important element for 3D printing.

#### Where could you study?

Institutions included below offer national certificates, diplomas and degrees that link to a related engineering field, such as mechanical engineering.

- Boland College
- Cape Peninsula University of Technology
- Central Johannesburg TVET College
- Central University of Technology, Free State
- Coastal KZN TVET College
- College of Cape Town
- Durban University of Technology
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- Esayidi TVET College
- Gert Sibande TVET College
- Goldfields TVET College
- King Sabata Dalindyebo TVET College
- Lephalale TVET College
- Majuba TVET College
- Maluti TVET College
- Mangosuthu University of Technology
- Mopani South East TVET College
- Mthashana TVET College
- Nelson Mandela University
- Nkangala TVET College
- North West University
- Northern Cape Rural TVET College
- Port Elizabeth TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane University of Technology



- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Pretoria
- University of South Africa
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College

Should you choose to study engineering, and specifically mechanical engineering, then subjects could include engineering mechanics, computer skills, mechanical engineering manufacturing, fluid mechanics, electrotechnology and applied mathematics.

### What's the duration of the certificate/diploma/ degree?

Courses differ in length. A diploma is a three-year programme, and a BTech degree is a four-year programme, while a national certificate could be a one-year qualification (depending on the course and institution you choose).

### General entry level requirements to study to become an agricultural in-field 3D printer operator?

For a diploma or a degree		:
English	:	4 (50-59%)
Mathematics	:	4 (50-59%)
Technical Mathematics	:	5 (60-69%)
Physical Sciences	:	4 (50-59%)
Physical Science	:	4 (50-59%)
Technical Science	:	4 (50-59%)

# Agricultural Innovation Technologist

**Emerging skill in South Africa**


### What does an agricultural innovation technologist do?

An innovation specialist is at the forefront of agricultural innovation, using mostly science and technology to address the many threats to the sector (but not discounting economic, social, cultural, and environmental aspects of future agriculture). A technologist looks at those major issues in agriculture (for example, those elements that may impact food production or the impact of a changing climate on agriculture) and seeks solutions. The job could entail gathering data, and developing, researching and designing new products or innovative methods to improve the situation.

#### Where could you work?

There are opportunities to work for a government department helping to create legislation or develop outreach, education, and upliftment programmes. In the private sector, agricultural innovation technologists could work for agricultural companies, fertiliser firms, or food manufacturing companies, as an example. Non-profit organisations and non-profit companies such as agricultural social auditing companies or assurance programmes could also require these skills, as could research institutions. This career is certainly also desirable in countries other than South Africa, although the level and kind of innovation required is likely to differ.

#### What could you study?

A Bachelor in Agriculture, or Bachelor of Applied Sciences, majoring in a subject related to agriculture or agricultural innovation could serve as a good foundation. However, a national certificate or diploma in agriculture could serve as an entry point (further study would be recommended).



- Boland College
- Cape Peninsula University of Technology
- Central University of Technology, Free State
- Ehlanzeni TVET College
- Elangeni TVET College
- Elsenburg Agricultural Training Institute
- Esayidi TVET College
- Gert Sibande TVET College
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Majuba TVET College
- Mangosuthu University of Technology
- Mthashana TVET College
- Nelson Mandela University
- North West University
- Owen Sitole College of Agriculture
- Potchefstroom College of Agriculture
- Stellenbosch University
- Taletso TVET College
- University of Fort Hare
- University of KwaZulu-Natal
- University of Limpopo
- University of Mpumalanga
- University of Pretoria
- University of South Africa
- University of the Free State
- University of Venda
- University of Witwatersrand
- University of Zululand South West Gauteng
- TVET College
- Waterberg TVET College
- West Coast TVET College

## What subjects and themes are you likely to study?

You would ideally choose the degree which holds your interest, and your subjects would be determined accordingly. But you could study subjects such as soil science, agrometeorology and crop production.

## What's the duration of the certificate/diploma/ degree?

This could be a three year or a four-year programme, depending on the course you choose, as well as the institution you choose.

## General entry level requirements to study to become an agricultural innovation technologist?

For a diploma or a degree		:
English	:	4 (50-59%)
Mathematics	:	3 (40-49%)
Life Sciences	:	4 (50-59%)
Or Physical Science	:	4 (50-59%)

## Agricultural Machine Learning Specialist

Scarce skill in South Africa

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## What does an agricultural machine learning specialist do?

Machine learning is a scientific field that gives machines the ability to learn without the need for lengthy programming. It's a sub-field of artificial intelligence, and its only goal is to feed data on past experiences and other relevant statistical data to the machine, for the machine to solve a certain problem.

A specialist in this field, therefore, builds intelligent machines. Here's an example: the specialist inputs an algorithm into a machine. This algorithm 'trains' the normal data, and reports any aberrations (for example, in temperatures or humidity that may affect a crop). Machine learning is believed to be a key element for a successful farming sector in the future.

#### Where could you work?

A specialist in this field would be tasked with developing, building, or maintaining existing systems. It could require you to work individually or to form part of a team of data scientists. And while there are opportunities available in South Africa, there is no shortage of opportunities currently in countries such as the United States. Many jobs are based at private companies, while several of universities (internationally) also employ scientists in this career. International institutions such as the World Bank could also require these skills.



#### What could you study?

Many companies and institutions (especially those based internationally) look to employ machine learning specialists who have their PhD, or at the very least, their master's degree in machine learning, data science or a relevant field (such as applied mathematics).

#### Where could you study?

These institutions could provide you with a diploma or degree with a focus on computer science.

- Cape Peninsula University of Technology
- Central University of Technology, Free State
- Durban University of Technology
- Mangosuthu University of Technology
- Nelson Mandela University
- North West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Limpopo
- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand

## What subjects and themes are you likely to study?

Subjects and themes could include robotics, perception and learning, deep learning, language engineering, mathematical modelling, artificial intelligence and pattern recognition, among others.

## What's the duration of the certificate/diploma/ degree?

This could be a three year or a four-year programme, depending on the course you choose, as well as the institution you choose. A postgraduate degree could be beneficial.

#### General entry level requirements to study to become an agricultural machine learning specialist?

:	4 (50-59%)
:	3 (40-49%)
:	5 (60-69%)
:	4 (50-59%)
	:

## Agricultural Mechanic

Scarce skill in South Africa



#### What does an agricultural mechanic do?

An agricultural mechanic maintains or fixes equipment on a farm or in a workshop, keeping it in good operational condition. That could include work on tractors, harvesting equipment and other machines, depending on the type of farm and crop. The agricultural mechanic of today makes use of computer-aided equipment to find faults, and even repair them, given that many of the engines operate by electrical systems. That's why a mechanic would need some experience working with computers, and knowledge of how the software works.

#### Where could you work?

This is a scarce skill, and jobs are available within both the private sector (working for companies such as agricultural retail outfits, or on a farm) or for government departments that support agricultural activities. Given that farmers operate around the world, and are likely to always need farming equipment, this career offers opportunities beyond South Africa's borders.

#### What could you study?

It's suggested that agricultural mechanics complete their national certificate N2 or higher, followed by work experience, experience, to be employed in the trade. There is also national certificate (vocational) training opportunities, which specialise in mechanics.

- Boland College
- Central Johannesburg TVET College
- Eastcape Midlands TVET College
- Elangeni TVET College
- False Bay TVET College
- Goldfields TVET College
- Maluti TVET College
- Northern Cape Rural TVET College
- Potchefstroom College of Agriculture
- Taletso TVET College
- Umfolozi TVET College

### What subjects and themes are you likely to study?

Subjects could include engineering graphics and design, engineering processes, applied engineering technology and mathematics.

## What's the duration of the certificate/diploma/ degree?

This depends on the route you choose, but a national certificate N2 or N3 are two or three-year programmes. A national certificate (vocational) training programme is a three-year qualification (bear in mind that practical training is also required).

## General entry level requirements to study to become an agricultural mechanic?

Admission requirements for a national certificate N1 could include:

Grade 11 with Mathematics: 4 (50-59%) OR Grade 12 with Mathematics or Mathematics Literacy: 4 (50-59%)



JAC BOSMAN Agri Mechanic

#### Laptops replace a spanner in this evolving career

Gone are the days when agricultural mechanics needed only a spanner, hammer and screwdriver to do their job. Today mechanics must have good computer skills – in a trade that has changed completely over the past few years.

Jac Bosman, the manager of the Overberg Agri workshop, based in Caledon in the Overberg, believes this gives young, up-andcoming mechanics the upper hand. "The youth has an advantage. They've grown up with computers and cellphones. So this comes naturally to them."

Jac has been in the industry for 27 years, starting as a mechanic for Overberg Agri, and working his way up to a managerial position, with 18 staff members reporting to him. He has seen how the industry has changed and developed. "The technology has advanced so much. Tractors and implements like combine harvesters are now high-spec machines, so it's all electronic. If there's a fault, these machines provide a fault code, which the mechanic can use to run diagnostics. That means mechanics are also in effect auto-electricians."

#### Problem solving skills are key

While much of the training to become an agricultural mechanic takes place on the job, it's suggested that those entering the industry complete a National Certificate N2 or N3, as well as compulsory work experience. After that they must pass the final

exam. "By the time you start working, you should have studied mathematics, engineering science and engineering drawing. And you must be able to do physical work, such as welding and soldering."

Aside from this, Jac says agricultural mechanics should be able to think on their feet. "Clients are often stressed when their equipment breaks down, because this often happens at an important time, like during the harvest season. So mechanics must be able to work well under pressure, solve problems and communicate well with others. They must also work in any weather conditions and should ideally be physically healthy."

His own job requires considerable planning to optimise his workshop and his team. He is responsible for quality control, the administration of running his team, dealing with clients, communicating with manufacturers and ensuring their computers and software are regularly updated with new agricultural software installments.

The job also entails travel – both locally to visit clients in the Overberg, but also in Africa and internationally, to service machinery and receive training in the latest product software needed to service and fix agricultural machinery.

#### **Head-hunting of mechanics**

Jac says that good agricultural mechanics are in great demand and are frequently head-hunted. "People are literally 'buying' mechanics, especially those with years of experience, or those who are willing to put in the hard work and stay up to date with the latest technology. This profession is definitely a scarce skill."

What's more, salaries for entry-level agricultural mechanics can be in line with graduates who have just finished their university degrees. But Jac says this profession should not be about the money. "You must have a passion for what you're doing. Sometimes the work can be repetitive. But there are other times that it's really fun – especially when you find and fix faults that no one has come across before. You get a pat on the back – and that can be very rewarding."

He adds, "You must also love agriculture. Every day you work with farmers who have a passion for their own businesses. So an interest in agriculture is very important."

## Agricultural Nano-robot Engineer

Emerging skill in South Africa



#### What does an agricultural nano-robot engineer do?

Nano-robot engineers work at the molecular scale. To give you an idea, a nanometre is a billionth of a metre. Nanorobots are therefore extremely small robots. Nanotechnology is already in use in the agricultural sector. They can help to increase yields by monitoring nutrients in the soil. They can also play a role in water-saving, through even-water distribution and water storage. While there are some job opportunities as a nano-robot engineer, it's good to know that the sector is still very much in the research and development phase. However, it's an exciting field, opening up the chance to interact with the environment in amazing detail.

#### Where could you work?

As an engineer, you could be at the forefront of developing new technologies. Imagine creating nano-sensors for measuring soil parameters, like nitrogen uptake. Or honeybee robots with carbon fibre bodies and titanium wings to pollinate an orchard or crop field. Attack robots could kill pests without the need for pesticides. Nanorobotics looks to bring this to reality. But this field is deep into the research and development phase, and most opportunities are currently in the research sector.



#### What could you study?

It could be beneficial to get a postgraduate degree behind your name in order to work in this sector. A BSc in Computer Science or a related field, followed by a postgraduate degree in Robotics or Nanotechnology could serve as an appropriate launchpad.

- Nelson Mandela University
- North West University
- Rhodes University (MSc Nanotechnology)
- Tshwane University of Technology
- University of Cape Town
- Wits University (MSc Robotics)





## What subjects and themes are you likely to study?

A Bachelor of Science could include subjects such as computer science, mathematics, physics, algorithms and programming or statistics.

## What's the duration of the certificate/diploma/ degree?

A Bachelor of Science is usually a three-year programme, although this does depend on the institution you choose.

## General entry level requirements to study to become an agricultural nano-robot engineer?

English or First additional language	: 5 (60-69%)
Mathematics	: 6 (70-79%)

## Agricultural Online Decisionmaking tool Developer

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Emerging skill in South Africa



## What does an agriculture online decision-making tool developer do?

Online decision-making tools guide their users to make better decisions. These tools are usually software-based, and lead the user step-by-step through decisions, offering likely outcomes based on each choice.

Such tools could include an application used on your smartphone, an online calculator, email alerts about the subject of your choice and more. As an example, in agriculture, this tool could help a producer become compliant in terms of the law, as it guides the producer through the steps to meet market or legislative requirements. A developer is responsible for creating these tools online, and ensuring they're easy to use, relevant, and can meet the user's needs (such as a farmer). A developer in this field would also be responsible for updates after release, for continued accuracy.

#### Where could you work?

This career is perhaps currently more common internationally than in South Africa, and as such, there may be more opportunities beyond South Africa's borders. Compiling an online decision-making tool is often a partnership between agriculture enterprises, research and innovation institutions and tertiary institutions. As a developer, you could also take on a freelance role, coding and engineering a tool independently.

#### What could you study?

It may be an idea to study computer science, programming, or app development as a starting point. There are certificates, diplomas and degrees that could provide a launchpad to the industry, as listed below.



- Boland College
- Buffalo City TVET College
- Cape Peninsula University of Technology
- Capricorn TVET College
- Central Johannesburg TVET College
- Central University of Technology, Free State
- Coastal KZN TVET College
- College of Cape Town
- Durban University of Technology
- Eastcape Midlands TVET College
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- False Bay TVET College
- Goldfields TVET College
- Ikhala TVET College
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Mangosuthu University of Technology
- Mnambithi TVET College
- Mopani South East TVET College
- Nelson Mandela University
- Nkangala TVET College
- North West University
- Northern Cape Urban TVET College
- Port Elizabeth TVET College
- Rhodes University
- Sekhukhune TVET College
- South West Gauteng TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane South TVET College
- Tshwane University of Technology
- Umfolozi TVET College
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Limpopo

- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

## What subjects and themes are you likely to study?

Should you study a degree in programming, then subjects could include machine learning tools and techniques, system software development, information technology, communication networks and problem solving and algorithms.

### What's the duration of the certificate/diploma/ degree?

A national certificate could be a one-year qualification, depending on the institution, while a diploma or degree could be a three or four-year programme.

## General entry level requirements to study to become an agricultural online decision-making tool developer?

For a diploma or a degr	ee	:
English	:	4 (50-59%)
Mathematics	:	3 (40-49%)
Mathematics Literature	:	5 (60-69%)
Technical Mathematics	:	4 (50-59%)

# Agricultural Robot Enginee

Scarce skill in South Afric

## What does an agricultural robot engineer do?

Robot engineers are at the forefront of creating the equipment smart farms use to operate more efficiently. Robotics refers to designing, building and then operating robots in automation. In agriculture, they are used to undertake those jobs that humans can't do, or can't do as well as a robot. Already robots are used to do jobs such as planting, picking and packing (and can identify fruit ready for harvest, versus fruit that's not ready).

Engineers in the sector might cross the boundary between robotics and biology, taking cues from nature to help design a robot for pollination or pest control. Or design a fleet of robots capable of harvesting, sorting and packing fruit and vegetables.

#### Where could you work?

There are robotics companies in South Africa that serve various industries, including the agricultural sector, with robots supporting picking and packaging (and various other applications). At the same time, robotics research is ongoing, with opportunities for robotics engineers working for research and tertiary institutions. Government departments are working to facilitate South Africa's move to the Fourth Industrial Revolution – that could also make use of these skills. There is strong demand for skills beyond South Africa.



#### What could you study?

Robotics or mechatronic engineering could serve as a foundation for this career, and it's suggested that a bachelor's degree could be a good starting point.

- Nelson Mandela University
- North-West University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Pretoria
- University of Witwatersrand
- University of Zululand

## What subjects and themes are you likely to study?

Subjects could include structural mechanics, dynamics and mechanical design, element structural analysis, computational fluid dynamics and maintenance science. You could also be exposed to key elements of mechatronics.

## What's the duration of the certificate/diploma/ degree?

A degree in mechatronics engineering is a four-year programme with most institutions.

### General entry level requirements to study to become an agricultural robot engineer?

Mathematics	:	5 (60-69%)
Physical Science	:	5 (60-69%)

# Agricultural Robot Maintenance specialist

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Scarce skill in South Afric



### What does an agricultural robot maintenance specialist do?

In agriculture, robots perform tasks such as spraying, weeding and moisture sensing. As a robot maintenance specialist, you would be responsible for preventative maintenance, software and hardware debugging, troubleshooting, and repairing the bot in the field or a workshop.

The job not only requires the maintenance specialist to maintain the robot itself, but also peripheral equipment, such as defective circuit boards, sensors, controllers, hydraulics, or pneumatics. You would also be required to maintain service records. The specialist needs to understand the software of the robot and how to correctly run updates, reformat, or reinstall it.

#### Where could you work?

There are similarities in job opportunities for robot engineers, maintenance specialists and robot operators. In many instances, the roles overlap, and companies that manufacture and provide robotics to the agricultural sector could make use of these skills. Research institutions could also employ people in this role. The role is sought-after in South Africa and internationally.

#### What could you study?

There are a few options to enter the robotics field. There are opportunities to study mechatronic engineering, which could provide a foundation for this career, although studying electrical engineering or mechanical engineering certificate, diploma or degree could also serve as an appropriate entry opportunity.

- Boland College
- Capricorn TVET College
- Central Johannesburg TVET College
- Coastal KZN TVET College
- College of Cape Town
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- Esayidi TVET College
- False Bay TVET College
- Gert Sibande TVET College
- Goldfields TVET College
- King Sabata Dalindyebo TVET College
- Lephalale TVET College
- Majuba TVET College
- Maluti TVET College
- Mnambithi TVET College
- Mopani South East TVET College
- Mthashana TVET College
- Nelson Mandela University
- Nkangala TVET College
- North West University
- Northern Cape Rural TVET College
- Port Elizabeth TVET College
- Sekhukhune TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane University of Technology
- University of Cape Town

- University of Pretoria
- University of South Africa
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

## What subjects and themes are you likely to study?

Should you opt for a degree in a mechatronics related field, subjects could include engineering graphics, mechanics, engineering maths, embedded systems, engineering software design and process automation.

## What's the duration of the certificate/diploma/ degree?

A diploma or degree in mechatronic engineering or electrical en-gineering is a three or four-year programme with most institutions.

General entry level requirements to study to become an agricultural robot maintenance specialist?

For a diploma or a deg	gree	:
English	:	4 (50-59%)
Mathematics	:	5 (60-69%)
Physical Science	:	5 (60-69%)

## Agricultural Robot Operator/ trainer

Scarce skill in South Africa



## What does an agricultural robot operator/trainer do?

Robotics is already offering systems to farmers and others in the agricultural sector, to help farmers harvest, plant, prune, spray, and monitor crops (and many other applications too). But while there's some concern that robots will replace people, for many of these robots, a human operator is still required to tell the robot what to do and how to do it. An operator could be brought in to provide this support. Alternatively, many companies are training the end-user to operate the robots.

#### Where could you work?

Operators in the sector can work for private companies that provide robotics to the agricultural sector. Given the rapid advances in the robotics industry (especially their application in agriculture), there are also opportunities in the research field, and working at tertiary institutions. The career requires you have a good understanding of robotics first and foremost (with a secondary interest in and knowledge of the agriculture industry). While there are opportunities in South Africa, this is especially a growing industry in many developed countries.

#### What could you study?

Robotics and mechatronic engineering could serve as foundations in this career while studying electrical engineering or mechanical engineering certificate, diploma or degree could also serve as an appropriate entry opportunity.

- Boland College
- Capricorn TVET College
- Central Johannesburg TVET College
- Coastal KZN TVET College
- College of Cape Town
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- Esayidi TVET College
- False Bay TVET College
- Gert Sibande TVET College
- Goldfields TVET College
- King Sabata Dalindyebo TVET College
- Lephalale TVET College
- Majuba TVET College
- Maluti TVET College
- Mnambithi TVET College
- Mopani South East TVET College
- Mthashana TVET College
- Nelson Mandela University
- Nkangala TVET College
- North West University
- Northern Cape Rural TVET College
- Port Elizabeth TVET College
- Sekhukhune TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Pretoria

- University of South Africa
- University of the Western Cape
- University of Venda

- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College
- Waterberg TVET College

### What subjects and themes are you likely to study?

Subjects could include dynamics and mechanical design, control systems, machine design, electronics and computer systems and more.

### What's the duration of the certificate/diploma/ degree?

This diploma or degree is a three or four-year programme with most institutions.

## General entry level requirements to study to become an agricultural online decision-making tool developer?

For a diploma or a deg	ree	:
English	:	4 (50-59%)
Mathematics	:	5 (60-69%)
Physical Science	:	5 (60-69%)

# Agricultural Software Developer

Scarce skill in South Africa



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#### What does an agriculture software developer do?

All hardware, like a robotic planter, requires a system (software) to make it work correctly. It's the interface between the user and the machine. Agricultural software developers are responsible for developing all types of software.

For example, a producer might need processing software to manage his or her packhouse (including traceability of product and shipping). Or it could entail creating software to help the flower industry monitor the impacts of harvesting over time. The developer could be responsible not only for writing the software, but also for maintaining it and fixing any bugs that could creep into the system. Because the role of software was already entrenched during the Third Industrial Revolution, this career opportunity is already well developed.

#### Where could you work?

There's a broad spectrum of opportunities available for agricultural software developers, as well as a well-publicised shortage of skills. An agriculture software solutions company offers software to clients, to help them run their businesses better. There are already numerous examples of companies offering such software solutions in South Africa (and beyond our borders). Tertiary institutions and government departments could also require these skills, locally and abroad, as could non-profit organisations providing support to the agriculture sector.

#### What could you study?

A diploma or degree in computer programming, software development or even applications development could serve as a good background to venture into this career. We have also included a range of colleges that offer an introduction to computer science and information technology here.

- Boland College
- Buffalo City TVET College
- Cape Peninsula University of Technology
- Capricorn TVET College
- Central University of Technology, Free State
- Coastal KZN TVET College
- College of Cape Town
- Durban University of Technology
- Eastcape Midlands TVET College
- Ehlanzeni TVET College
- Ekurhuleni East TVET College
- Ekurhuleni West TVET College
- Elangeni TVET College
- False Bay TVET College
- Goldfields TVET College
- Ikhala TVET College
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Mangosuthu University of Technology
- Mnambithi TVET College
- Mopani South East TVET College
- Nelson Mandela University
- Nkangala TVET College
- North West University
- Northern Cape Urban TVET College
- Port Elizabeth TVET College
- Rhodes University
- Sekhukhune TVET College
- South West Gauteng TVET College
- Stellenbosch University
- Taletso TVET College
- Tshwane North TVET College
- Tshwane South TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Limpopo
- University of Mpumalanga
- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Western Cape
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vhembe TVET College
- Vuselela TVET College Central Johannesburg TVET College
- Waterberg TVET College

### What subjects and themes are you likely to study?

Depending on the institution you choose, subjects could include system software development, information technology, communication networks and problem solving and algorithms.

### What's the duration of the certificate/diploma/ degree?

A diploma is a three-year programme at most institutions, while a degree is a three or four-year programme, depending on the course you choose, as well as the institution.

### General entry level requirements to study to become an agricultural software developer?

English	:	4 (50-59%)
Mathematics	:	3 (40-49%)
Mathematics Literature	:	5 (60-69%)
Technical Mathematics	:	4 (50-59%)

# Agricultural Web Publisher

Scarce skill in South Africa



What does an agricultural web publisher do?

A web publisher uploads and publishes content on the internet, for example a website. This certainly sounds pretty simple. But there are a couple of things an agricultural web publisher needs to be successful:

knowledge on creating and updating a website, skill to create the content in an engaging way for a digital audience (write or film), and knowledge about the subject (in this instance, agriculture). To stand out above the rest, the content should be of high quality, interesting, and easy to understand and access. The role of web publishers has become even more important in recent times: now more than ever people are reading and consuming information online. That makes this career very relevant to society today.

#### Where could you work?

In this career, you could work for yourself (for your own website or digital platform), or freelance for others. Or you could work for a company such as an online agricultural media house or even an agricultural scientific online journal. The opportunities in this field aren't limited to only South Africa, as web publishers are employed around the world (or can even be based in South Africa, while working for international publishers).

#### What could you study?

A communications or journalism diploma or degree could serve as a strong foundation to become an agricultural web publisher, after which you could specialise in agriculture.

#### Where could you study?

- Cape Peninsula University of Technology
- Central University of Technology, Free State
- Durban University of Technology
- North West University
- Rhodes University
- Tshwane University of Technology
- University of Limpopo
- University of the Free State
- University of South Africa
- University of Witwatersrand



### What subjects and themes are you likely to study?

Subjects could include journalism, media studies, media application technology, entrepreneurship and more.

### What's the duration of the certificate/diploma/ degree?

An advanced diploma could be a one-year programme, providing entry into a bachelor's degree, which is a three-year programme at most institutions.

### General entry level requirements to study to become an agricultural web publisher?

:	5 (60-69%)
:	4 (50-59%)
:	3 (40-49%)
:	4 (50-59%)
	:

# **Clean Meat Grower**

Emerging skill in South Africa



#### What does a clean meat grower do?

Clean meat is also known as lab-grown or cultured meat. This process takes a sample of animal cells and grows it in a lab. As the world population continues to increase, demand for meat is also predicted to rise - to the extent that there won't be enough land available to meet the demand for meat a few decades from now. The idea of lab-grown meat is also popular because it's considered more environmentally friendly (with fewer greenhouse gasses emitted). Already companies have been given the go-ahead to produce and sell clean meat to consumers (in countries such as Singapore).

#### Where could you work?

A clean meat grower works in a laboratory, either for a company that produces clean meat or for research institutions that are researching the technology. International start-ups, academics and the public sector are also taking an active interest in this technology, as are many anti-cruelty non-profit organisations. This industry is still very much in the development phase in South Africa – with countries such as Israel, the Netherlands, America and Singapore more advanced in promoting this industry.

#### What could you study?

You would need to have a scientific background, such as cell biology or tissue engineering, to enter this field (consider a BSc degree). Training as a food scientist or a food technician could serve as an entry point.

#### Where could you study?

- Cape Peninsula University of Technology
- Durban University of Technology
- Mangosuthu University of Technology
- Nelson Mandela University
- North West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Pretoria
- University of South Africa
- University of the Free State
- University of Venda
- University of Witwatersrand
- University of Zululand

Subjects could include chemistry, cell biology, mathematics for life sciences, biochemistry, microbiology and more.

A Bachelor of Science or Bachelor of Applied Chemistry is a three-year programme with most institutions.

English	:	4 (50-59%)
Mathematics	:	4 (50-59%)
Life Sciences	:	4 (50-59%)
Physical Sciences	:	4 (50-59%)

# Climate change Economist

**Emerging skill in South Africa** 



### What does a climate change economist do?

Economist researches and analyses often complex economic data and trends, to make economic forecasts. This is no different should you become a climate change economist – except that you look at data relating to climate change, and the likely economic impacts and economic opportunities of a changing climate. A climate change economist could be tasked with developing strategies to further an organisation. Company or even country's impact as it transitions to a lower-carbon economy. A climate change economist would need to have a good understanding of climate models.

#### Where could you work?

While the climate change theme is not new in South Africa, this career is still very much in development phase. Most economists in South Africa are still focused on a broader definition of economics and are rarely solely focused on climate change. Despite this, there are opportunities for an economist with special skills in climate change modelling in the private sector and working for some non-profit organisations.

Government departments require these skills in their climate change adaptation and mitigation efforts, and tertiary institutions also require economists with these skills. This career is, however, more common internationally, working for the United Nations or other not-for-profit or research institutions.



#### What could you study?

While a bachelor's degree in economics is essential, many organisations and institutions would require a master's degree (in economics), with experience in climate change modelling. Some institutions offer a Bachelor of Economics, majoring in Environmental Science.

#### Where could you study?

- Nelson Mandela University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of Limpopo
- University of Pretoria
- University of South Africa
- University of the Free State
- University of Venda
- University of Witwatersrand
- University of Zululand



### What subjects and themes are you likely to study?

At a graduate-level (before specialising), you could study subjects such as finance, information systems, risk management, law and politics.

### What's the duration of the certificate/diploma/ degree?

Although an advanced diploma is a one-year programme at some institutions, in order to specialise as a climate change economist, it could be suggested to obtain a bachelor's degree, which could be a three-year programme, depending on your institution of choice.

### General entry level requirements to study to become a climate change economist?

English Home Language or First additional language:5 (60-69%)Mathematics:5 (60-69%)

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## Environmental Lawyer

Scarce skill in South Africa

# ENVIRONMENTAL



#### What does an environmental lawyer do?

All South Africans have the right to a healthy environment. But this is regulated by complex national (as well as international) legislation. An environmental lawyer represents these environmental interests – therefore having a good understanding of environmental laws (such as environmental rights, the law of the sea, climate change, sustainability and much more). As a lawyer, you would not only represent clients in a court of law, but could also teach environmental law, or even write laws relating to the environment for a country.

#### Where could you work?

Many environmental lawyers work for private companies, but there are also civil society organisations that help communities and individuals to enjoy their Constitutional right to a healthy environment. Opportunities exist within local, provincial and national spheres of government, as well as in academia. Should you study in South Africa, you would most likely need to complete a bridging course or write bar exams to practice internationally (depending on the country you choose to practice in).

However, you could still work as an advisor in another country. What's more, the education you would receive in South Africa (in common law, Roman-Dutch law and Constitutional law) would prepare you well to work in other countries.



#### What could you study?

The best route to become an environmental lawyer could be to study an LLB (Bachelor of Law), and then follow this up with a master's degree in environmental law.

#### Where could you study?

- Nelson Mandela University
- North West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- Unisa
- University of Cape Town
- University of Fort Hare
- University of Johannesburg
- University of KwaZulu-Natal
- University of Limpopo
- University of Pretoria
- University of the Free State
- University of the Witwatersrand
- University of Venda

### What subjects and themes are you likely to study?

While this depends on your institution of choice, subjects could include Constitutional law, law of property and labour law.

### What's the duration of the certificate/diploma/ degree?

The LLB is a four-year programme at most institutions.

### General entry level requirements to study to become an environmental lawyer?

You may have to write a national benchmark test in order to study an LLB. Your entry requirements depend on the university you choose, but could include:

National Senior Certificate average of at least	:	70%
English/Afrikaans (Home language)	:	5 (60-69%) OR
English/Afrikaans (First additional language)	:	6 (70-79%)



**DANJELLE MIDGLEY** Environmental lawyer

### Environmental law: Being an activist for nature and social justice

In the past, environmental lawyers used to only deal with "green" issues, like the welfare of animals. That's no longer the case, says environmental lawyer, Danjelle Midgley. "Our Constitutional right to a healthy environment is actually a human right."

She offers the example of how pollution and environmental degradation not only affect biodiversity, but also impact on human life. "I believe that environmental law is located in the struggle for social justice in South Africa," she says.

Danjelle works for the Centre for Environmental Rights (CER), a non-profit organisation advocating and litigating for environmental justice, working with communities and civil society organisations.

While she is a practising attorney, her day-to-day tasks as Environmental Law Specialist are diverse. She undertakes legal research to advise and support the CER's programmes. She monitors litigation and changes in environmental law. And she looks for ways to empower young black graduates in the public interest field.

She also acts as the CER's parliamentary liaison, attending committee debates on mining, energy, the environment and agriculture. "Many of our current Members of Parliament are young, and many are new to environmental law, which is very detailed and complex. So, when requested by Parliament, we provide support and training to MPs. We also submit comments on draft amendments to environmental laws to improve our environmental regulatory regime."

#### Playing an "activist" role

For Danjelle, environmental law allowed her to play a more activist role in South Africa. "I've always been passionate about the environment. In high school, I was inspired after meeting an environmental lawyer and hearing about the cases she worked on. That's when I decided that I would like to work in a field that supports the environment."

While she first completed a music degree, Danjelle went on to obtain her LLB and then her Master's in Environmental Law from the University of Cape Town. She also spent a semester at the University of Maryland in America, a university renowned for its environmental law department.

She recommends students consider a legal degree as a postgraduate degree. "If you complete a general LLB, there are few opportunities to choose subjects you are passionate about. However, you can specialise at master's level and focus on what you're interested in."

Students and young graduates should also consider getting work experience through internships at environmental law firms. "I had the opportunity to get work experience at various law firms and I'm grateful for those opportunities. They gave me a good idea of the work I would do later in my profession."

#### Seeing tangible change for nature

The most rewarding part of her job is her involvement in litigation. "I love legal research, delving into cases and thinking about arguments. But I see the most tangible change through litigation." For example, through litigation, the CER and its civil society partners recently blocked the development of a large new coal-fired power station, which would have emitted huge amounts of greenhouse gases for decades and been destructive for communities in the surrounding areas.

Being passionate about the environment is an important trait for environmental lawyers – as is good communication and organisational skills. She adds: "It helps being a team player. Communication with colleagues is important – especially with so many people working from home now during the Coronavirus pandemic. We communicate and share ideas with each other. And we're open to arguments when deciding on litigation and advocacy strategies."

# Food Preservation Technologist

Scarce skill in South Africa

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### What does a food preservation technologist do?

#### The control of microorganisms (like bacteria) in foods from 'farm to fork' is important to ensure consumer health and wellbeing, to prevent food spoilage and deterioration.

A food preservation technologist must make sure the products under their care don't spoil. They use preservation techniques to do this, such as applying heat, fermenting the food or controlling the atmosphere. This is important for the food we eat, as well as animal feed (and other agriculture food products). They could start with the oversight of the raw material, and work through the processing and storage phases, or could focus on an individual process in more detail.

#### Where can you work?

From barley to beer, beef to burger, a food preservation technologist could be involved in researching and designing processes, working for either research institutions or for food manufacturing companies. Tertiary institutions could make use of these skills.



#### What could you study?

A degree or diploma in food science or food technology could serve as a good foundation.

#### Where could you study?

- Cape Peninsula University of Technology
- Durban University of Technology
- Stellenbosch University
- Tshwane University of Technology
- University of Johannesburg
- University of Pretoria
- University of the Free State
- University of Venda

### What subjects and themes are you likely to study?

You're likely to study subjects such as chemistry, biochemistry, microbiology, food preservation, product development and food processing.

### What's the duration of the certificate/diploma/ degree?

A food technology degree or diploma is three years, and a food science degree is four years.

### General entry level requirements to study to become a food preservation technologist?

Mathematics	:	4 (50-59%)
Physical Sciences	:	4 (50-59%)
Two languages	:	4 (50-59%)
Two other subjects	:	4 (50-59%)

# Sustainable Agriculture Analyst

Emerging skill in South Africa



### What does a sustainable agriculture analyst do?

A sustainable agriculture analyst supports the sector to become more sustainable – in most cases making use of new and green technologies. The analyst is likely to focus on elements such as water efficiency, renewable energy, energy resilience, as well as providing market information to promote innovation. Renewable energy, in particular, can help make farms more competitive, especially as prices of renewable technology decreases, making them more affordable to farmers and others involved in agriculture.

#### Where can you work?

Analysts could work for the Department of Agriculture or other spheres of government, or for non-profit organisations. Private agriculture consultancies could employ them to support the farming sector, and universities and other tertiary institutions could make use of their services to find new ways of farming sustainably.

#### What could you study?

A bachelor's degree in agriculture, environmental sciences or resource management could serve as a basis for a career as a sustainable agriculture analyst. It's likely some employers would require further study, such as a master's or even doctorate in any of these fields. Here we've included institutions that offer a certificate, diploma and degrees in agriculture, which could serve as an appropriate launchpad into the career.

#### Where could you study?

- Boland College
- Cape Peninsula University of Technology
- Central University of Technology, Free State
- Ehlanzeni TVET College
- Elangeni TVET College
- Elsenburg Agricultural Training Institute
- Esayidi TVET College
- Gert Sibande TVET College
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Majuba TVET College
- Mangosuthu University of Technology
- Mthashana TVET College
- Nelson Mandela University
- North West University
- Owen Sitole College of Agriculture
- Rhodes University
- Stellenbosch University
- South West Gauteng TVET College
- Taletso TVET College
- Tshwane University of Technology
- University of Cape Town
- University of Fort Hare
- University of KwaZulu-Natal
- University of Limpopo
- University of Mpumalanga
- University of Pretoria
- University of South Africa
- University of the Free State
- University of Venda
- University of Witwatersrand
- University of Zululand
- Waterberg TVET College
- West Coast TVET College

### What subjects and themes are you likely to study?

If you choose to obtain a background in environmental science, then subjects could include environmental economics, environmental law, water resources, biological resources and more.

### What's the duration of the certificate/diploma/ degree?

A diploma is a three-year programme, while a bachelor's degree is either a three or four-year programme.

### General entry level requirements to study to become a sustainable agriculture analyst?

For a diploma or a deg	:		
Mathematics	:	4 (50-59%)	
Physical science	:	4 (50-59%)	
English/Afrikaans	:	3 (40-49%)	





# **Vertical Farme**

**Emerging skill in South Africa** 



#### What does a vertical farmer do?

Vertical or "inside" farming produces crops in vertical rather than flat areas of land. Think of shelving or a high tower of crops inside a warehouse. A vertical farmer cultivates plants, animals, fungi or other life forms commercially, by stacking them on top of each other – to sell as food or other products. Because vertical farms don't require the space needed that traditional farms require, they're often based in cities.

And this can bring down the cost of transport to the market. Vertical farms usually make use of controlled environmental conditions (such as temperature and humidity). Vertical farmers are currently mostly involved in greenhouses and hydroponics, although future uses could include desalination, as an example.

#### Where could you work?

Vertical farming is growing rapidly around the world (especially in Japan and the Netherlands), including in South Africa. However, research is still ongoing, and some agriculture sectors aren't yet cost-effective when farmed vertically. There are opportunities working for companies that help potential vertical farmers create productive indoor farms. There are also research opportunities in the field, working for organisations such as the Agricultural Research Council. And with the right input and knowledge, entrepreneurs can set up their own vertical farming operations.

#### What could you study?

There are many courses available on vertical farming. It may be a good idea to obtain a basic education in agriculture (a course, certificate, diploma or degree) before studying further as a vertical farmer.

#### Where could you study?

- Boland College
- Cape Peninsula University of Technology
- Cedara College of Agriculture
- Central University of Technology, Free State
- Coastal KZN TVET College
- College of Sustainable Agriculture
- Ehlanzeni TVET College
- Elangeni TVET College
- Elsenburg Agricultural Training Institute
- Esayidi TVET College
- Gert Sibande TVET College
- Grootfontein Agricultural Development Institute
- King Hintsa TVET College
- King Sabata Dalindyebo TVET College
- Lovedale TVET College
- Madzivhandila College of Agriculture
- Majuba TVET College
- Mangosuthu University of Technology
- Mthashana TVET College
- Nelson Mandela University
- North West University
- Owen Sitole College of Agriculture
- Potchefstroom College of Agriculture
- South West Gauteng TVET College
- Stellenbosch University
- Taletso TVET College
- Tompi Seleka College of Agriculture
- Tshwane University of Technology
- Umfolozi TVET College
- University of Fort Hare
- University of KwaZulu-Natal
- University of Limpopo
- University of Mpumalanga

- University of Pretoria
- University of South Africa
- University of the Free State
- University of Venda
- University of Witwatersrand
- University of Zululand
- Vuselela TVET College
- Waterberg TVET College
- West Coast TVET College

### What subjects and themes are you likely to study?

Subjects could include (depending on your institution of choice): farm management, financial management, applied farming techniques, plant production, irrigation and more.

### What's the duration of the certificate/diploma/ degree?

This varies greatly between various institutions. Theoretical study is usually between one to two years, while practical study could be one year, or one and a half years.

### General entry level requirements to study to become a vertical farmer?

Grade 12 or any other equivalent qualification.

### How to get in touch with your institution of choice:

#### **Universities:**

#### Cape Peninsula University of Technology

PO Box 1906 Bellville 7535 Tel. 021 959 6767 Email: info@cput.ac.za Website: www.cput.ac.za

#### Central University of Technology, Free State

Private Bag X20539 Bloemfontein 9300 Tel. 051 507 3911 Website: www.cut.ac.za

#### **Durban University of Technology**

PO Box 1334 Durban 4000 Tel. 031 373 2000 Email: info@dut.ac.za Website: www.dut.ac.za

### Mangosuthu University of Technology

511 Mangosuthu Highway Umlazi KwaZulu-Natal 4031 Tel. 031 907 7111 Email: info@mut.ac.za Website: www.mut.ac.za

#### **Nelson Mandela University**

PO Box 77000 Port Elizabeth 6031 Tel. 041 504 1111 Email: info@mandela.ac.za Website: www.mandela.ac.za

#### **North West University**

Private Bag X1290 Potchefstroom 2520 Tel. 0860 169698 Email: studies@mynwu.info Website: www.nwu.ac.za

#### **Rhodes University**

PO Box 94 Makhanda (Grahamstown) 6140 Tel. 046 603 8111 Email: communications@ru.ac.za Website: www.ru.ac.za

#### Stellenbosch University

Private Bag X1 Matieland 7602 Tel. 021 808 9111 Email: info@sun.ac.za Website: http://www.sun.ac.za

#### **Tshwane University of Technology**

Staatsartillerie Road Pretoria West Pretoria 0183 Tel. 086 110 2421 Email: general@tut.ac.za SMS number: 30655 Website: www.tut.ac.za

#### **University of Cape Town**

Private Bag X3 Rondebosch 7701 Tel. 021 650 9111 Email: graduation@uct.ac.za Website: www.uct.ac.za



#### **University of Fort Hare**

1 King Williamstown Rd Alice 5700 Tel. 040 602 2011 Website: www.ufh.ac.za

#### **University of the Free State**

PO Box 339 Bloemfontein 9300 Tel. 051 401 9111 Email: info@ufs.ac.za Website: www.ufs.ac.za

#### University of Johannesburg

PO Box 524 Auckland Park 2006 Tel. 011 559 4555 Email: mylife@uj.ac.za Website: www.uj.ac.za

#### University of KwaZulu-Natal

Mazisi Kunene Road Glenwood Durban 4041 Tel. 031 260 1111 Email: enquiries@ukzn.ac.za Website: www.ukzn.ac.za

#### **University of Limpopo**

Private Bag X1106 Sovenga 0727 Tel. 015 268 9111 Email: enrolment@ul.ac.za Website: www.ul.ac.za

#### **University of Mpumalanga**

C/O R40 and D725 Mbombela 1200 Tel. 013 002 0001 Email: info@ump.ac.za Website: www.ump.ac.za

#### **University of Pretoria**

Private Bag X20 Hatfield 0028 Tel. 012 420 3111 Email: ssc@up.ac.za Website: www.up.ac.za

#### University of South Africa Prelier Street

Muckleneuk Ridge Pretoria 0003 Tel. 0800 00 1870/012 441 5888 Email: study-info@unisa.ac.za Website: www.unisa.ac.za

#### University of Venda

Private Bag X5050 Thohoyandou Limpopo 0950 Tel. 015 962 8000 Email: info@univen.ac.za Website: www.univen.ac.za

#### University of the Western Cape

Robert Sobukwe Road Bellville 7535 Tel. 021 959 2911 Email: info@uwc.ac.za Website: www.uwc.ac.za

### University of Witwatersrand, Johannesburg

1 Jan Smuts Avenue Braamfontein 2000 Johannesburg Tel. 011 717 1000 Website: www.wits.ac.za

#### **University of Zululand**

1 Main Road Vulindlela KwaDlangezwa 3886 Tel. 035 902 6000 Email: info@unizulu.ac.za Website: www.unizulu.ac.za

#### **Colleges:**

#### Boland College Private Bag X5068 Stellenbosch 7599 Tel. 021 886 7111 Website: www.bolandcollege.com

#### Buffalo City TVET College

St Marks Road Southerwood East London 5200 Tel. 043 743 6554 Email: admin@bccollege.co.za Website: https://www.bccollege. co.za

#### Capricorn TVET College

16 Market Street Polokwane 0700 Tel. 015 230 1800 Website: http://www. capricorncollege.edu.za

#### Central Johannesburg TVET College

5 Ubla Avenue Off Princess of Wales Terrace Parktown, Johannesburg Tel. 011 351 6000 Email: info@cjc.edu.za Website: https://cjc.edu.za

#### **Coastal KZN TVET College**

PO Box 1795 Amanzimtoti 4126 Tel. 031 905 7000 Email: info.coastal@kzntvet.edu.za Website: www.coastalkzn.co.za

#### College of Cape Town

334 Albert Road Salt River Cape Town 8001 Tel. 021 404 6700 Email: info@cct.edu.za Website: https://www.cct.edu.za

#### Eastcape Midlands TVET College

Private Bag X35 Uitenhage 6230 Tel. 041 995 2000 Website: https://emcol.co.za

#### Ehlanzeni TVET College

Corporate Centre 29 Bell Street Nelspruit 1200 Tel. 013 752 7105 Email: support@ehlanzenicollege. co.za Website: https://www. ehlanzenicollege.co.za

#### Ekurhuleni East TVET College

Heald Street Private Bag X01 Daveyton 1507 Tel. 011 730 6600 Website: http://www.eec.edu.za

#### Ekurhuleni West TVET College

Private Bag X1030 Germiston 1400 Tel. 011 323 1600 Email: info@ewc.edu.za Website: http://www.ewc.edu.za

#### Elangeni TVET College

Private Bag X9032 Pinetown 3610 Tel. 031 716 6700 Email: info@elangeni.edu.za Website: www.elangeni.edu.za

#### Esayidi TVET College

Private Bag 814 Port Shepstone 4240 Tel. 039 685 5482 Website: https://www.esayidifet. co.za

#### Esri South Africa College

C/O New Road and 6th Road Midrand 1685 Tel. 011 238 6300 Email: info@esri-southafrica.com Website: www.esri-southafrica.com

#### False Bay TVET College

Private Bag X25 Tokai 7966 Tel. 021 787 0800 Website: https://www. falsebaycollege.co.za

#### Gert Sibande TVET College

18a Beyers Naude Street Standerton 2430 Tel. 017 712 9040 Email: sithole.ss@gscollege.edu.za Website: https://gscollege.edu.za

#### **Goldfields TVET College**

36 Buren Street Flamingo Park Welkom 9459 Tel. 0800 203 610 Email: admin@goldfieldstvet.edu. za Website: http://goldfieldstvet.edu. za

#### Ikhala TVET College

Gwadana Drive Ezibeleni Eastern Cape 5326 Tel. 047 873 8800 Website: https://www.ikhala.edu.za

#### King Hintsa TVET College

218 Mthatha Road Mchubakazi Tel. 047 401 6400 Email: info@kinghintsacollege.edu. za Website: http://www. kinghintsacollege.edu.za/home

#### King Sabata Dalindyebo TVET College

R61 Queenstown Road Cicira Village Mthatha 5099 Tel. 047 505 1000 Email: admissions@ksdtvetcollege. edu.za Website: https://www.ksdcollege. edu.za

#### Lephalale TVET College

Lephalale 0555 Tel. 014 763 2252 Email: marketing@leptvetcol.edu.za Website: https://leptvetcol.edu.za

#### Lovedale TVET College

1 Amatola Row King William's Town 5600 Tel. 040 604 0700 Website: http://www.lovedale.edu.za

#### Majuba TVET College

83 Allen Street Newcastle 2940 Tel 034 326 4888 Website: https://majuba.edu.za

#### Maluti TVET College

Mampoi Road Phuthaditjhaba 9866 Tel. 058 713 6100 Website: https://www.malutitvet. co.za

#### Mnambithi TVET College

77 Murchison Street Ladysmith 3370 Tel. 036 631 0380 Email: info.mnambithi@feta.gov.za Website: https://www. mnambithicollege.co.za

#### Mopani South East TVET College

C/O Calvin Ngobeni & Tambo Namakgalae 1391 Tel: 015 781 1513/14 Email: svdc@mopanicollege.edu.za Website: http://mopanicollege.edu. za/

#### Mthashana TVET College

266 South Street Vryheid 3100 Tel. 034 980 1010 Email: mthashana@feta.gov.za Website: https://www. mthashanacollege.co.za

#### Nkangala TVET College

C/O Haig & Northey Witbank 1035 Tel. 013 658 4700 Website: http://www.ntc.edu.za

#### Northern Cape Rural TVET College

1 Steve Naude Street Blydeville Upington 8800 Tel. 054 332 4711 Website: https://ncrtvet.com

#### Northern Cape Urban TVET College

37-41 Long Street Kimberley 8301 Tel. 053 839 2063 Website: http://ncutvet.edu.za

#### Port Elizabeth TVET College

1 Richmond Hill Drive Richmond Hill 6001 Tel. 041 509 6000 Email: info@pecollege.edu.za Website: http://www.pecollege. edu.za

#### Sekhukhune TVET College

Tel. 013 269 0278 Email: sekfet@sekfetcol.co.za Website: http://www. sekhukhunetvet.edu.za
## South West Gauteng TVET College

1822 A Molele Street C/O Koma Road & Molele Street Soweto Tel. 086 176 8849 Website: https://www.swgc.co.za

## Taletso TVET College

761-762 Setlogelo Drive Montshiwa Unit 2 Mahikeng 2790 Tel. 018 384 2341 Email: info@taletsocollege.co.za Website: https://taletso.edu.za/ courses

## **Tshwane South TVET College**

85 Francis Baard (Schoeman Str.) Pretoria 0001 Tel. 012 401 5000 Email: info@tsc.edu.za Website: http://www.tsc.edu.za

#### **Tshwane North TVET College**

C/O Kgosi Mampuru & Pretorius Street Pretoria 0001 Tel. 012 401 1600 Email: info@tnc.edu.za Website: https://tnc.edu.za

## Umfolozi TVET College

Naboomnek Street Arboretum Richards Bay Tel. 035 902 9501 Email: info@umfolozi.edu.za Website: www.umfolozicollege. co.za

## Vhembe TVET College

Private Bag X2136 Sibasa 0950 Tel. 015 963 7000 Email: info@vhembecollege.edu.za Website https://www. vhembecollege.edu.za

## Vuselela TVET College

8 Bram Fischer Street Klerksdorp 2571 Tel. 018 406 7800 Website: www.vuselelacollege.co.za

## Waterberg TVET College

C/O Totius & Hooge Street Mokopane 0600 Tel. 015 492 9000 Email: marketing@ waterbergcollege.co.za Website: https://www. waterbergcollege.co.za

#### West Coast TVET College

2 Loedolf Street Malmesbury Tel. 022 482 1143 Email: info@westcoastcollege.co.za Website: https://www. westcoastcollege.co.za

## **Agricultural Colleges:**

## Cedara College of Agriculture

Private Bag X6008 Hilton 3245 Tel. 033 355 9304 Email: college@kzndard.gov.za Website: www.kzndard.gov.za/ colleges/cedara-college-ofagriculture

## Elsenburg Agricultural Training Institute

Private Bag X1 Elsenburg 7607 Tel. 021 808 7700 Email: DOA.Info@westerncape.gov.za Website: https://www.elsenburg. com/elsenburg-agricultural-traininginstitute/

#### Fort Cox Agriculture and Forestry Training Institute

PO Box 2187 King Williams Town 5600 Tel. 040 653 8033 Email: info@fortcox.ac.za Website: https://www.fortcox.ac.za

## Grootfontein Agricultural Development Institute

Private Bag X529 Middelburg Eastern Cape 5900 Tel. 049 802 6600 Website: http://gadi.agric.za

# Madzivhandila College of Agriculture

Private Bag X5024 Thohoyandou 0950 Tel. 015 962 7200 Website: www.madzicollege.gov.za

## Owen Sitole College of Agriculture

Private Bag X20013 Empangeni 3880 Tel: 035 795 1345 Email: njabulo.ngcobo@kzndae. gov.za Website:www.kzndard.gov.za/ colleges/owen-sitole-college-ofagriculture

## Potchefstroom College of Agriculture

Chris Hani Street Potchefstroom Rural 2 Potchefstroom 2520 Tel. 018 285 0700 Email: potchcollege@nwpg.gov.za Website:https://potchagricollege. co.za/

## Tompi Seleka College of

Agriculture Private Bag X9619 Marble Hall 0450 Tel. 013 264 5376 Website: www.tompicollege.gov.za



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Western Cape Department of Agriculture Private Bag X1, Elsenburg, 7607 Tel: 021 808 5111 Email: DOA.Info@westerncape.gov.za www.elsenburg.com

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