



AWS INVESTMENT IN SOUTH AFRICA

AWS Economic Impact Study



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Executive Summary



When Amazon Web Services (AWS) invests in areas around the globe, the company creates trackable and demonstrable economic growth in the communities it operates in. This study describes the economic impact of AWS's infrastructure investment in the AWS Africa (Cape Town) Region. It also discusses the positive ripple effects of this investment on employment, sustainability, digital education, and longer-term financial stability for local individuals.

One could argue that cloud computing can be traced back to the founding of the Amazon Elastic Compute Cloud ([Amazon EC2](#)) in 2006, which AWS engineers in Cape Town helped to develop together with other AWS teams across the world. Amazon EC2 initially provided a single virtual server instance, which allowed customers to access practically unlimited cloud-computing capacity without an on-premises data center. In April 2020, AWS launched the AWS Africa (Cape Town) Region with a plan to expand related infrastructure and operations in South Africa through 2029. The Region serves developers, start-ups, and enterprises, as well as government, education, and non-profits from across Africa, bringing the innovation and digital growth benefits of AWS's technology to the continent.

To estimate the effects of AWS's investment in South Africa, this economic impact study draws from the financial projections of Amazon, the input-output methodology used by AWS, and statistical tables published by the [Organization for Economic Co-operation and Development](#) (OECD).

- **AWS plans to invest ZAR 46 billion in the AWS Africa (Cape Town) Region from 2018–2029**, including the capital and operating expenditures associated with constructing, connecting, operating, and maintaining the Cape Town Region. Of the total planned investment, AWS **has already invested ZAR 15.6 billion between 2018–2022**. All expenses are directly attributable to the project, such as the imports of highly specialized and proprietary equipment and software, and in-country spending on construction and data center operations. This investment generates revenue across industries, including construction, engineering, energy consulting, plumbing, maintenance, and security, mostly through local businesses.

¹The local currency values in this report were obtained by using the March 2, 2023 spot exchange rate of ZAR 18.1772 per U.S. dollar. At the time of publication, the total capital and operational planned investment value is \$2.5 billion, and contribution to GDP is \$4.4 billion.

- The investment associated with the AWS Africa (Cape Town) Region will **contribute an estimated ZAR 80 billion to the GDP of South Africa from 2018–2029. By the end of 2022, the AWS investment in Cape Town had generated ZAR 12 billion in domestic GDP.** The GDP contribution includes the value added by AWS to South Africa’s information technology (IT) sector and in-country spending on goods and services related to the construction and operation of AWS’s data centres.
- AWS investment creates a ripple effect in South African communities, **supporting an estimated annual average of more than 5,700 full-time equivalent (FTE) jobs at local vendors** in the South African data center supply chain. The FTE jobs are being supported throughout many sectors across the data center supply chain, such as telecommunications, non-residential construction, electricity generation, facilities maintenance, and data center operations. Moreover, AWS is committed to supporting the digital literacy goals set out in South Africa’s *National Digital and Future Skills Strategy* through innovative workforce development programmes.
- Amazon launched a **10 megawatt (MW) solar plant in South Africa’s Northern Cape Province in 2022.** The plant is expected to generate up to 28,000 megawatt-hours (MWh) of renewable energy per year, which equals the annual electricity consumption of over 8,000 average South African homes. It will additionally avoid producing an estimated 25,000 tons of carbon emissions annually, which is the equivalent of removing 5,400 cars from the roads in South Africa. The solar plant is majority-owned by Black women and operated by a fully South African–owned company. AWS is on a path to achieving Amazon’s companywide goal of using 100% renewable energy by 2025. The company is committed to building sustainable business operations for its customers, communities, and the world through industry-leading renewable energy and water initiatives in South Africa.



AWS Overview

AWS provides cloud computing, which is the on-demand delivery of IT resources over the internet. Instead of purchasing, owning, and maintaining servers, customers can access computing power, data storage, and other services from a cloud provider like AWS. AWS offers pay-as-you-go pricing, where customers only pay for the resources they use, as opposed to the traditional IT model where expenses come as a fixed cost. Organizations of all types, sizes, and industries use the cloud for various purposes, including data backup and recovery, software development and testing, data analytics, enterprise resource planning, email, virtual desktops, contact centres, and customer-facing web services.

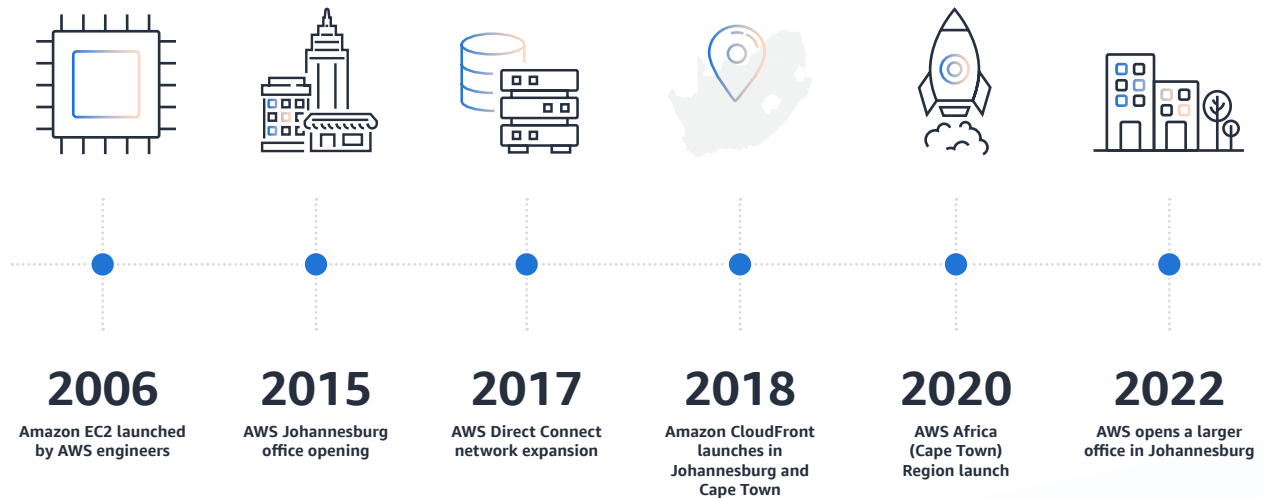
Cloud computing users have access to a broad range of the latest technologies, so they can innovate faster, experiment freely, and quickly set up and use resources as needed. They do not have to overprovision resources upfront to handle peak levels of business activity in the future. Instead, they provision only the resources they need. AWS is the world's most comprehensive and broadly adopted cloud provider, offering more than 200 fully featured services from data centres globally. Millions of customers—ranging from start-ups to large enterprises and public sector organizations—use AWS to lower costs, increase agility, and innovate faster.

AWS helps customers launch and grow their businesses. Access to cloud computing lowers the cost of starting new businesses, encourages innovation, and spurs development of new technologies. It also attracts more funding for start-ups, which generates further economic growth. Researchers from Harvard University and Massachusetts Institute of Technology (MIT) found that AWS lowers the cost of starting new businesses by 15%–27%. Their study affirms that *"many practitioners see the introduction of cloud computing services by Amazon as a defining moment that dramatically lowered the initial cost of starting internet and web-based start-ups."*²

In addition to economic gains, replacing in-house computing with cloud technology is also better for the environment. A [study](#) by 451 Research estimates that AWS's infrastructure is 3.6 times more energy efficient than the median of U.S. enterprise data centres surveyed and up to five times more energy efficient than the average in Europe. By adopting AWS technology, private and public sector organizations can take advantage of the energy efficiency and clean energy goals of AWS while meeting their own computing needs.

²Ewens M, Nanda R, and Rhodes-Kropf M. Cost of Experimentation and the Evolution of Venture Capital. NBER Publications. National Bureau of Economic Research, 2018.

AWS Network Services and Infrastructure



The AWS Africa (Cape Town) Region adds to the company's ongoing investment in South Africa, creating trackable and demonstrable economic growth. After Amazon EC2, a single virtual server instance was launched in 2006 by AWS engineers, it eclipsed 1 million compute instances by 2009, 2 million instances four months later, and 3 million instances two months after that. At that point, the Amazon EC2 team stopped counting. Today, AWS offers over 500 Amazon EC2 instance types supporting combinations of processors, memory, storage, and networking capacity, which can be tailored for any workload.

Increasing the Local Presence

In 2015, AWS opened an office in Johannesburg, South Africa. This initiative contributed significantly to growing teams of high-performing professionals like account managers, business development managers, customer services representatives, partner managers, professional services consultants, solutions architects, technical account managers, and many others to help customers move to the cloud.

“With thousands of African companies using AWS for years, we’ve been able to witness first-hand the technical talent and potential in Africa.”

**Andy Jassy,
CEO of Amazon**

Growing the Global Network

In 2017, the Amazon global network expanded into Africa through [AWS Direct Connect](#). This cloud service helps customers improve application performance by connecting directly to AWS and bypassing the internet.

In 2018, AWS established its first cloud infrastructure on the African continent, launching [Amazon CloudFront](#) locations in Johannesburg and Cape Town, to help organizations securely deliver content with low latency at high transfer speeds.

Launching the AWS Africa (Cape Town) Region

In 2020, Amazon launched the AWS Africa (Cape Town) Region with three Availability Zones. An [AWS Region](#) is a physical location comprising multiple, isolated, and physically separate Availability Zones, which in turn form clusters of logically connected data center infrastructure. Availability Zones may be located up to 100 kilometres (km) apart to protect against natural and man-made disasters that could affect their data centres.

The design of AWS's multiple Availability Zones in every AWS Region offers advantages for customers. For example, each Availability Zone has independent power, cooling, and physical security, and they are connected by redundant, ultra-low latency networking. AWS customers focused on high-availability can design their applications to run in multiple Availability Zones to achieve even greater fault tolerance. Like all AWS Regions around the world, the Availability Zones in the Cape Town Region have backup power to keep operating if electrical failures and load-shedding in the country take place.

Expanding the South African Footprint

In 2022, AWS opened a larger office in Johannesburg to support growing customer demand. The office supports South Africa's growing cloud sector and provides a range of services to organizations from start-ups to enterprises to public sector agencies, to help them innovate, lower IT costs, and accelerate migrations to the cloud.

Data Security and Compliance



Customer Security Is the Priority

With the AWS Africa (Cape Town) Region, AWS is committed to helping its South African customers comply with or exceed the country's legal and regulatory standards and achieve the highest levels of security, privacy, and resiliency. AWS offers the most secure cloud environment available, meaning AWS customers have the freedom to build services quickly and efficiently using world-leading technology. The large network of AWS Partners in South Africa specializes in delivering security-focused solutions and helping customers manage compliance and secure workloads through every stage of cloud adoption, ranging from initial migration to day-to-day management.

AWS Customers Can Keep Content Local

AWS customers always retain ownership and control of their digital content, including where it is stored, how it is stored, and what access is granted to whom. Customers can also choose to encrypt their content at rest or in motion, using AWS tools or supported third-party security solutions, while maintaining full control of the encryption keys. With 31 AWS Regions launched globally, AWS customers can store their content in AWS Regions around the world, including the AWS Africa (Cape Town) Region. AWS customers retain control of what security they choose to implement to protect their own content, platform, applications, systems and networks.

Ripple Effect: Economic Impact of AWS's Investment in South Africa

AWS investments create a measurable economic impact on communities through constructing, connecting, operating, and maintaining AWS data centres. This involves job creation that helps to provide longer-term financial stability for South Africans. AWS **plans to invest ZAR 46 billion in the AWS Africa (Cape Town) Region from 2018–2029** as it builds, maintains, and operates data centres to support the projected growth in demand for its technology by its customers. Of the total planned investment, AWS already **invested ZAR 15.6 billion between 2018–2022**. The investment includes all cash expenses directly attributable to the AWS Region, such as imports of highly specialized and proprietary equipment and software, and in-country (local) spending.

Local spending includes capital expenditures (CAPEX) on construction labor, materials, and services, as well as recurring operating expenditures (OPEX) on employee and contractor compensation, utility fees, and facilities and rental costs. AWS plans to progressively expand infrastructure and grow corporate operations to meet projected demand for its services in South Africa and across Africa.

This study estimates that the planned investment associated with the AWS Africa (Cape Town) Region will **contribute ZAR 80 billion to the GDP of South Africa from 2018–2029**, based on Amazon financial projections, the established input-output methodology,³ and statistical tables provided by the **OECD**. **Between 2018–2022, the AWS investment in Cape Town generated ZAR 12 billion in local GDP**. The GDP contributed by the AWS Africa (Cape Town) Region includes the value added by AWS services to the IT sector in South Africa as well as the direct, indirect, and induced effects of AWS's purchases from the South African data center supply chain. This study estimates that the in-country portion of AWS investment will **support an average of more than 5,700 FTE jobs annually at external vendors in South Africa from 2018–2029**. Estimates of the average number of these jobs include the following:

- **More than 2,200 jobs annually sustained by direct effects**—These are jobs at AWS suppliers that are directly supported by AWS investment, which are in sectors such as non-residential construction, software development, facilities maintenance, electricity generation, and telecommunications.

³ See Appendix A for details of the methodology

- **More than 1,510 jobs annually sustained by indirect effects**—These jobs are in the AWS supply chain and are indirectly supported by business-to-business transactions resulting from AWS investment. These include jobs in sectors that supply the skilled labor and services needed to fulfil work for AWS.
- **More than 1,990 jobs annually sustained by induced effects**—These are jobs in the broader South African economy supported by the household consumption of workers receiving compensation from AWS and its supply chain. They include jobs in sectors that supply consumer goods and services to South African households.

The following illustration provides a conceptual breakdown of the supply chain impacts into direct, indirect, and induced effects.



Catalysing Broad-Based Economic Growth

Since the launch of the AWS Africa (Cape Town) Region in 2020, **thousands of active customers** in Africa use AWS technology every month to accelerate innovation, increase agility, and drive cost savings. South African-based enterprises, start-ups, and public sector organizations use AWS technology to power their digital transformation, scale their impact, and provide improved services to local customers and citizens.

AWS Locations in South Africa



AWS Region:

Africa (Cape Town)



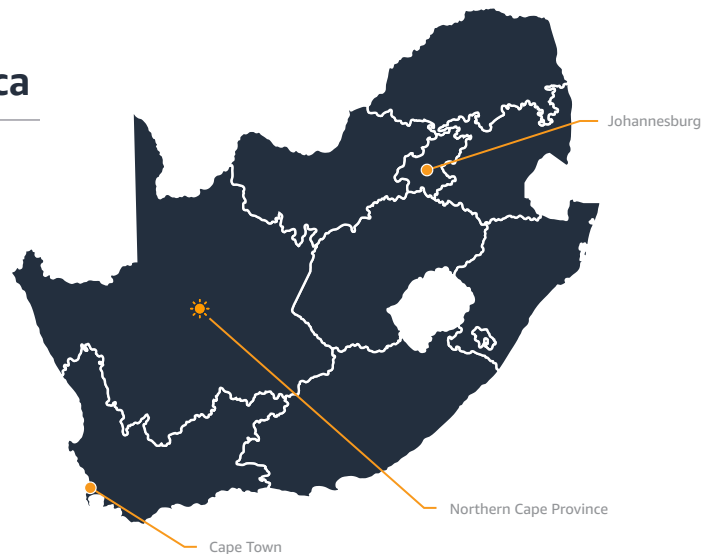
AWS Edge Network:

Johannesburg



Renewable Energy Project:

10 MW solar plant in the Northern Cape Province



In 2019, AWS launched the **AWS Equity Equivalent Investment Programme (EEIP)** as part of South Africa's Broad-Based Black Economic Empowerment (B-BBEE) programme, attaining a **Level 1 B-BBEE certificate** in March 2020. The EEIP is an **AWS Partner Network (APN)** development and acceleration programme for 100% Black-owned small IT businesses in South Africa.

According to the International Finance Corporation, **small business ownership in South Africa reflects patterns of racial and gender-based inequality in the broader society**. As the sizes of the country's small businesses grow, the rates of Black, youth, and female business ownership decline. AWS believes that building diverse teams allows businesses to innovate better. To that end, the EEIP plans to invest more than ZAR 365 million toward developing 100% Black-owned, local small businesses in the IT sector through December 2026.

As part of the EEIP, small, medium, and micro-sized enterprises (SMMEs) have the opportunity to participate in an 18- to 24-month enterprise development and incubation programme to become certified developers and solutions architects in the APN. As of 2022, the programme had increased revenues and supported the direct creation of 75 permanent jobs at local businesses, including 24 positions for women and 17 for youth and young adults who range in age from 18 to 35.

Through the EEIP, AWS will continue to help SMMEs with building technical capacity and skills to deliver services, expanding into new regions, accessing capital for training and product development, and receiving customer deal support.

Customers Benefit From AWS Technology



Public Sector

GovChat, Wits University



Enterprise

Old Mutual, Pick n Pay, Standard Bank



Start-ups

Africam, Entersekt, Pineapple

Customized Solutions for the Public Sector

The South African government recognizes the power of the cloud in transforming government services. In July 2022, the Honourable Khumbudzo Ntshavheni, the minister of communications and digital technologies, said that, *"through the use of cloud computing analytics, the government will be able to deliver public services to citizens by optimizing and redirecting scarce resources in order to reach as many citizens with much more diverse needs."*

The country's public sector, including research institutions, museums, and health sciences organizations, often chooses AWS to improve the quality and efficiency of service it delivers to South African citizens. The AWS Africa (Cape Town) Region brings advanced and secure cloud technology that opens up opportunities for innovation, entrepreneurship, and digital transformation in the public sector.

GovChat is South Africa's largest citizen-government engagement platform. The platform provides a conversational interface that integrates voice and text into applications, and provides a unified platform that citizens can use to connect with the government. In addition, GovChat enhances governance transparency and accountability through the provision of tools for citizens to measure service levels, combined with the technology and empirical data analytics for the government to improve its services.

In May 2020, AWS Partner Synthesis developed a way to integrate **AWS Lambda** and **Amazon Lex** on the GovChat platform, which resulted in connecting 50 million citizens to 10,000 South African government representatives and more than 60,000 public facilities. At the time, the platform provided critical services during the pandemic. The South African Department of Social Development and Social Services Agency (SASSA) was also able to provide COVID-19 social relief with distress grants to more than 15 million South Africans who were unemployed and in need of financial support. GovChat transferred and verified data securely and in real time, integrating the department's existing internal approval and disbursement infrastructure for the grant payments to South African citizens in need of government social assistance.

In another example, **University of the Witwatersrand (Wits University)**, South Africa's largest research university with about 38,000 students per year, has adopted a cloud-first approach to its IT strategy, using technology to enhance all its core processes. Responding to the COVID-19 pandemic in 2020, the institution **migrated its Learning Management System (LMS), Sakai, to AWS** within two months, becoming the first university in the country to continue its semester without any interruptions.

AWS has deepened its presence in South Africa over the last two decades with a focus on transforming education. It has enabled several universities, including the North-West University, University of Limpopo, University of Pretoria, and University of the Free State, to embrace online learning and a new cloud-driven future of education at an affordable cost. The first major step for the University of Limpopo was to deploy its LMS, Blackboard, in the cloud to meet the increased demand generated by the pandemic, which the institution's on-premises infrastructure was not capable of handling.

Driving Enterprise Innovation

Established enterprises across Africa have reinvented themselves into modern digital businesses at an accelerated rate with AWS. South African enterprises such as Absa Group Limited, Investec, Medscheme, MiX Telematics, Old Mutual Limited, Pick n Pay, Standard Bank Group Limited, and Travelstart are building on AWS to innovate, expedite, and deploy customer-centric solutions at scale.

In 2019, **Old Mutual**, Africa's largest and oldest financial services provider, selected AWS as its preferred cloud provider and began migrating over 1,000 core insurance applications and product administration systems to the cloud. As part of this transition, Old Mutual shut down its data centres in November 2022. The company is working with AWS machine learning (ML) technologies, such as Amazon Lex, to develop a chatbot for their oldmutual.co.za website. This is enabling Old Mutual to provide responses to customers instantly, through the customer's preferred channel—voice, email, web, or text.

Pick n Pay is one of the largest retailers in Africa, with over 80,000 employees across 1,560 stores. The company migrated its ecommerce, data analytics systems, and mobile customer application to AWS, resulting in increased agility and financial benefits of the cloud-based architecture over the past year. By moving away from their previous managed services model, Pick n Pay has experienced performance, reliability, and cost savings. The success of the migration has also led the company to move their SAP Business Warehouse systems to certified [AWS X1 instances](#).

Standard Bank, Africa's largest lender by assets, uses [Amazon SageMaker](#) to enhance its customer experience. Amazon SageMaker includes advanced fraud detection and ML-based advisor capabilities, empowering customers to make better financial decisions. The bank has established an AWS Cloud Center of Excellence with a dedicated team facilitating migration to the cloud and building AWS Training and Certification programmes to upskill all employees. AWS and Standard Bank also collaborated to launch an education and digital skills programme across South Africa, to help prepare the next generation of cloud experts.

Accelerating Start-up Growth

African start-ups are choosing AWS as the foundation for their businesses, including Aerobotics, Apex Innovation, Asoriba, BusinessOptics, ColonyHQ, Custos Media, EMS Invirotel, Entersekt, Graylink Media, JourneyApps, JUMO, Mukuru, Parcelninja, Simfy Africa, Zapper, and Zoon. These companies are using cloud infrastructure to overcome prohibitive upfront costs and minimize overhead, enabling them to spend what capital they have on innovation, scaling their businesses, and improving service delivery.

With the help of programmes like [AWS Activate](#), 2,631 companies received access to more than ZAR 340 million in cloud-promotional credits between 2018–2022. Start-ups use these credits for scalable, reliable, and secure services, such as compute, storage, databases, analytics, ML, Internet of Things (IoT), and artificial intelligence (AI).

AWS technology and its resulting business benefits help start-ups get off the ground and grow, which in turn generates economic opportunities through entrepreneurship and employment. In the South African context, a [World Bank economic analysis](#) found that with digital technologies, young entrepreneurs have the potential to address the job crisis, which was worsened by the COVID-19 global pandemic in an environment of weakened economic growth. According to the World Bank's analysis, self-employment represents only 10% of jobs in South Africa compared to about 30% in most upper-middle-income economies, including Turkey, Mexico, and Brazil. If South Africa could match the self-employment rate of its peers, unemployment rates could potentially be halved.

South Africa has an increasing number of start-ups, especially in the digital sector, which are growing fast and could become an engine of future job creation.

⁴World Bank. South Africa Economic Update, Edition 13: Building Back Better From COVID-19 with a Special Focus on Jobs. World Bank, 2021.

Africam is a South African media company that livestreams high-definition (HD) footage from animal waterholes located across Africa. The company aims to create an online community focused on education and conservation by connecting people worldwide to African wildlife. As a start-up, Africam provides free streams to millions of users in more than 200 countries. The AWS Africa Region provides the company with the bandwidth required to stream high-resolution content to its viewers.

Entersekt, an authentication and mobile application security company, is using the scalability of AWS to support world-renowned financial services organizations, including Absa, Capitec Bank Limited, Nedbank Group Limited, Swisscard AECS GmbH, and more. Entersekt uses AWS to send fully encrypted data from their banking customers' on-premises environments to the cloud. This high level of security helps Entersekt's customers across 45 countries to secure more than 150 million transactions per month, drastically reducing online and mobile banking and payment fraud rates.

Pineapple is a mobile platform that provides users with a unique insurance offering. Through their app, users can quickly receive an insurance quote by simply taking a picture of the item. Users can form pools of funds from which their claims are paid, and unused premiums can be withdrawn at the end of the year. Pineapple uses AWS services, such as Amazon EC2, for secure and scalable compute capacity to operate their innovative platform.

“
Our customers are large financial institutions for whom even minutes of downtime are unacceptable. AWS has ensured extremely high service levels, even as transactions continue to double every six months”

Schalk Nolte,
CEO of Entersekt

Growing South Africa's Digital Ecosystem

The APN helps AWS customers build, migrate, and accelerate their businesses in the cloud. It indirectly supports employment at more than 100 AWS Partners by actively offering services in South Africa, more than 60 of which are headquartered in the country. The APN helps AWS Partners build innovative solutions and services in the cloud for their customers and end users by providing partners with access to a dedicated portal, business and technical support, training, and benefits.

After joining the APN, AWS Partners can enrol in a **Partner Path** best aligned with their organization to validate their offerings and demonstrate their AWS expertise. AWS's Partner Paths provide support for organizations that develop software that runs on AWS; develop hardware devices that work with AWS; deliver consulting and professional services; sell, deliver, or incorporate AWS training; and recruit, onboard, and support their partners to resell and develop AWS solutions.

Through its EEIP programme, AWS has enabled participating South African companies to achieve **AWS Advanced Partner** tier. This designation signifies that the awardees possess a strong team of technically proficient and certified professionals, and have demonstrated excellence in customer experience.

Disraptor, a technology and digital consulting firm headquartered in Johannesburg, is helping customers streamline their cloud infrastructure management through their expertise in software development and DevOps. Disraptor achieved impressive milestones within 18 months of joining the EEIP programme, including adding seven AWS technical certifications, reaching over 1,000% revenue growth, and attaining AWS Advanced Tier Services Partner status from the APN.

OptiSolutions is a technology company that specializes in supporting medium and large enterprises with business-critical IT systems. Its services include cloud migration, AWS environment management, and website and application development powered by AWS. For over a decade, OptiSolutions has provided managed services and products to support business growth for industry leaders in energy and telecoms. OptiSolutions has also leveraged AWS to achieve their economic goals. Through the AWS EEIP programme, it developed a cloud service for both new and existing customers while providing a secure environment for employee development. A key advantage of its services is the rapid scaling for their customers and the ability to build teams quickly.

Reliance Cloud provides cloud migration services, as well as machine learning and artificial intelligence solutions in South Africa. In September 2020, the company was selected to be the first AWS EEIP cohort, giving the company access to funding and technical assistance. Through this programme, Reliance Cloud was able to establish a delivery team and become an AWS Select Tier Services Partner within six months. When Reliance joined the programme, they only had two employees. But in less than a year, its staff grew to 10 employees and 11 customers, with revenue steadily growing each month.

“Without the AWS EEIP, we could not have gotten to this point so quickly. The programme has enabled us to transform from a start-up to an active organization with structure, offices, and teams that can drive new business.”- Reliance Cloud Co-founder and CEO Simon Herold

Accessing Customers in AWS Marketplace

To further enable the AWS Partner community in Africa, AWS created the South Africa **AWS Marketplace** in 2020. AWS Marketplace was launched on the same day as the Africa (Cape Town) Region launch. AWS Partners in South Africa can now complete transactions in AWS Marketplace, empowering them to access and market to millions of AWS customers around the world. Also, AWS’s global customers can purchase directly from South African-based software and data providers through AWS Marketplace, selecting from a total of 10,000 software listings and data products from more than 2,500 sellers globally. AWS Partners in South Africa are unlocking new sources of business growth by accessing a broader customer base and completing transactions in a global marketplace. This creates a larger variety of business opportunities for South African citizens.

Local Community Impacts

Building on measurable economic impacts from its infrastructure development in Cape Town, AWS is committed to being a good neighbour in the communities where it builds and operates data centres through its [AWS InCommunities](#) programme.

AWS InCommunities aims to have a lasting impact in AWS Regions around the world where employees work, live, and raise their families. Going beyond traditional classroom education, the AWS InCommunities programme extends its educational interventions to empower communities in science, technology, engineering, arts, and mathematics (STEAM) education equity, and access; local tech upskilling; environmental stewardship; and employee engagement. By focusing on these critical areas, AWS InCommunities aims to make a significant difference in the lives of people and communities around the world.

In South Africa, AWS is investing in the future of technology communities and bridging the digital skills gap. AWS InCommunities is enhancing talent diversity through tech events that target youth cohorts, especially young girls and women. Some of the initiatives include collaborating with AfricaTeenGeeks, a non-governmental organisation (NGO) dedicated to teaching children how to code; Code4CT, an organization aimed at inspiring and empowering youth; and GirlCode, which focuses on empowering women through technology. AWS engineers work closely with these and other organizations to provide coaching, mentoring, and access to AWS credits.

Tangible Africa, with support from AWS, created RANGERS—an offline smartphone game app that teaches problem solving and coding to underrepresented communities in South Africa. For example, RANGERS challenges players to catch a poacher with a net to save a rhino, helping thousands of young people across South Africa to learn problem solving and coding without using a computer. In 2022, more than [17,000 young people played RANGERS as part of Coding4Youth](#), a coding tournament launched by Nelson Mandela University's computer science department in partnership with the Leva Foundation and sponsored by AWS InCommunities.



Photo credit: Amazon Web Services
Young South Africans playing RANGERS as part of a Coding4Youth tournament

"We were coding in stadiums, coding with school choirs in their choir camps, and even coding with learners who were just hanging out in their villages," said Lusanda Maqungo, one of more than 40 coding evangelists trained to go into schools and give presentations on coding to students and their teachers.

AWS also worked with Standard Bank's Engineering Skills Development Programme in South Africa to develop bespoke community initiatives that support pre-employment outcomes and aim to close the cloud skills gap in Africa within five years. One such initiative is the all-women cloud certification skills race, which was launched in September 2022 with Girl Code. It has already attracted 3,366 registrations, with 94% African and 93% youth and young adults between ages of 18 and 34. AWS is committed to making a difference in the lives of the communities it serves and contributing to a more inclusive and innovative future for all.

Training and Workforce Development Opportunities

Amazon is investing hundreds of millions of dollars to help **29 million people around the world grow their tech skills by 2025** by offering free cloud computing training. Through its **Training and Certification** programmes, AWS equips individuals and teams with the necessary skills to innovate on AWS. The company's investment in the AWS Africa (Cape Town) Region is greatly benefiting South Africa's cloud-education programming.

With these types of training programmes, South African learners are empowered to build with confidence, enabling leaders to drive transformation and deliver results for their organizations. And for the learners, AWS programmes are equipping them with the knowledge and tools they need to succeed in the digital economy. AWS's continued investment in workforce development aligns with South African **President Cyril Ramaphosa's vision to prepare the country for the Fourth Industrial Revolution (4IR)**.

AWS works with higher education institutions in South Africa, including Durban University of Technology, Stellenbosch University, and the University of Cape Town, in a bid to help them prepare the country's future workforce. The **AWS Academy** programme provides the universities with a free, ready-to-teach cloud computing curriculum to prepare students to pursue industry-recognized AWS certifications and in-demand cloud jobs. The programme also enables educators to stay up to date with cloud innovation and train students for one of the country's fastest-growing industries. AWS Academy offers courses such as AWS Academy Cloud Foundations, AWS Academy Cloud Architecting, AWS Academy Machine Learning, and AWS Academy Data Analytics.

In 2019, **AWS established the eKasi initiative** to help young people, small businesses, and students in South Africa build their technology skills and develop business solutions for the future. The AWS eKasi initiative offers a one-year, intensive training course for students to gain a fundamental understanding of software development and cloud computing technologies. The initiative is a collection of AWS resources available through programmes such as **AWS Educate** and AWS Academy. eKasi provides an opportunity for residents and students throughout the country to create technology solutions for their communities by collaborating with local townships.

“

We want to be a country where our people are digital citizens, our workforce is skilled and empowered, and our youth enjoy the transformative benefits of employment in a new world of work”

**Cyril Ramaphosa,
President of the Republic
of South Africa**

In October 2020, AWS launched its first Africa cohort of **AWS re/Start** in Johannesburg through a collaboration with Praesignis, which continues to add additional cohorts. AWS re/Start is designed to provide free, 12-week skills development and job training to individuals from underemployed and underrepresented South African communities. AWS re/Start offers hands-on training in programming, networking, security, and databases, and provides career coaching and interview opportunities with local employers. Programme participants are offered the opportunity to take the **AWS Certified Cloud Practitioner exam** and obtain an industry-leading certification at no cost. AWS re/Start aims to build local talent and provide new career opportunities in cloud computing for those with little technology experience.

In 2022, the Africa Women Innovation and Entrepreneurship Forum (AWIEF) partnered with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and AWS to launch a Digital Skills Training (DSET) programme for young women in South Africa. This AWIEF programme is a new cohort of AWS re/Start, which is aimed at enhancing the skill levels and employability of unemployed and underemployed women aged 21 to 40 years old. Over 60% of the graduates secured entry-level positions at various South African organizations.

The Development Bank of South Africa (DBSA) is supporting skills training, youth employment, and entrepreneurship by building 20 Development Labs (DLABS) across the country. Currently, three DLABS are already operational. The DLABS are a social- development infrastructure initiative aimed at providing access to previously inaccessible skills, education, and services. Reconstructed Living Lab (RLABS), an AWS social impact training partner in South Africa, has been appointed as one of the training partners by the DBSA. They are providing foundational-level AWS training in Alex, Soweto, and Mitchells Plain to unemployed youth. This collaborative effort is expected to enhance the digital skills of the youth, enabling them to compete in the global economy and drive economic growth in South Africa.



Photo credit: Reconstructed Living Lab
AWS Training and Certification meets the RLABS team in Mitchells Plain, Cape Town

Case Study

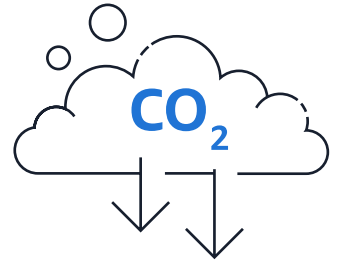


The Harambee Youth Employment Accelerator

AWS and Business Processing Enablers South Africa (BPESA), the leading global business services (GBS) industry association in South Africa, have partnered with the youth employment accelerator Harambee as part of a BPESA's programme on future skills. The programme trains and places unemployed, recent high school graduates in GBS jobs.

The GBS sector is expected to create a minimum of 250,000 jobs in South Africa over the next seven years, but it faces a shortage of people with cloud-ready skills. AWS is providing educational and development programmes to help the country bolster this sector's workforce. Andrew Searle, director of BPESA's Future Skills programme, said creating an enabling, learning environment for South Africa's youth will be crucial to digital transformation. *"By hosting AWS-authored courses on the BPESA Future Skills platform, BPESA participants in the Digital Workforce Accelerator can benefit from quick and cost-effective access to cloud skills that align with GBS and ICT sector needs,"* Searle said.

AWS and Sustainability



The Climate Pledge to Reach Net-Zero Emissions

Amazon is committed to becoming a more sustainable business. A co-founder of [The Climate Pledge](#) in 2019, Amazon was among more than 300 other businesses that committed to reaching net-zero carbon by 2040 —10 years ahead of the [Paris Agreement](#).

Amazon is the world's largest corporate purchaser of renewable energy and is on a path to powering its operations with 100% renewable energy by 2025—five years ahead of its original target of 2030. AWS moves toward these goals by constantly improving the energy efficiency of its computing resources and by increasing the share of renewable energy in total consumption by its data centres.

In November 2021, AWS [launched](#) its first operational solar project in South Africa, which contributes renewable energy to the electricity grid. Located in the Northern Cape, South Africa's largest province, the 10 MW solar project supplies renewable energy to AWS data centres and contributes to South Africa's renewable energy goals.

The solar plant is expected to generate up to 28,000 megawatt-hours (MWh) of renewable energy per year, which equals the annual average household electricity consumption of over 8,000 South African homes. This supply of renewable energy will result in avoiding an estimated 25,000 tons of carbon emissions annually, the equivalent of removing 5,400 cars from the road in South Africa. The solar plant is majority-owned by Black women and operated by a fully South African-owned company.

As of the end of 2022, Amazon announced [401 renewable energy projects in 22 countries globally](#). This brings Amazon's total portfolio to more than 20 gigawatts (GW) of clean energy capacity, an amount that could generate enough electricity to power 5.3 million U.S. homes. With these continued investments, Amazon set a new corporate record in 2022 for the most renewable energy usage announced by a single company in one year. The company remains the largest corporate buyer of renewable energy—a position it's held since 2020, according to [Bloomberg New Energy Finance](#).



Emissions Reductions

AWS designs server systems with great attention to power optimization, using the latest technology components. It runs servers at higher-usage levels than enterprise data centres, leveraging the ability to share and dynamically allocate resources in the cloud. The **AWS Graviton3** processor is an example of how the company builds hardware with sustainability in mind. Graviton3-based Amazon EC2 instances use up to 60% less energy for the same performance than comparable Amazon EC2 instances. In addition to energy reduction, Graviton3 offers 25% faster speeds, providing boosted performance for science, cryptographic, and ML workloads.

Facility-level improvements in efficiency include data-center designs that use lower energy methods and a leaner electrical infrastructure, resulting in lower energy losses to power distribution. As South African customers move their workloads from enterprise data centres to AWS, the carbon footprint of these workloads is reduced due to much lower energy consumption.

Other initiatives to ensure energy efficiency include live displays of energy consumption on screens in buildings, the use of energy-efficient lightbulbs and lighting controls (occupancy sensors and daylight sensors) and energy-efficient equipment based on energy star labels, and the installation of photovoltaic panels on all the roofs.

All Amazon-rented buildings achieved “World Leadership” or “South African Excellence” Green Star ratings by the Green Building Council South Africa (GBCSA) in 2022, meaning that the building designs and interior fit-outs are sustainable and environmentally conscious. Additionally, AWS implemented community engagement activities focused on environmental stewardship, including two half-day beach clean-ups, vegetable garden planting initiatives, and a tree-planting initiative.

Reduction of Water Use in AWS Data Centres

In addition to energy efficiency, AWS is committed to conserving and reusing water—both in its on-site operations and by working with private and public entities to support water availability in communities where it operates data centres.

On South Africa’s hottest days when AWS needs water for cooling, the company optimizes systems to use minimal water. Outside air is cooled through an evaporative process and pushed into the server rooms to keep hardware at stable operating temperatures. During the cooler months, whenever possible, the system supplies the data center with outside air that doesn’t need to be cooled. It uses real-time sensor data to adapt to changing weather to further reduce water use.

The company also evaluates the opportunity to reduce its consumption of potable water and is actively expanding its use of nonpotable and recycled water for cooling purposes. In certain Regions, it works directly with utilities and regulators to obtain approval for the use of recycled water in direct evaporative cooling technology.

AWS continues to work with water utilities in areas around the world to expand its recycled water infrastructure. Through these actions, it is actively contributing to sustainable water solutions by reducing its impact on the local potable water supply for the communities where it operates. AWS also uses on-site, modular water-treatment systems in multiple Regions, which allow the company to remove scale-forming minerals and reuse water for more cycles. Increasing its “cycles of concentration” contributes to reducing the water intake needed to cool its data centres. Along with reducing water usage, AWS also looks for opportunities to return water to the communities where it operates.

Water Positive by 2030

AWS is committed to become **water positive** by 2030. To meet this commitment, AWS will return more water to our communities that we use in our direct operations. The company announced its 2021 global water use efficiency metric of 0.25 litres of water per kilowatt-hour, demonstrating AWS's leadership in water efficiency among cloud providers.

This initiative adds to Amazon's commitment of \$10 million to **Water.org** to support the launch of the Water & Climate Fund, which will deliver climate-resilient water and sanitation solutions to 100 million people across Africa, Asia, and Latin America. This donation will directly empower 1 million people with water access by 2025, providing 3 billion litres of water each year to people in water-scarce areas.

Case Study



SHANA—The eThekwini Municipality Water

The eThekwini Municipality, a large coastal city in South Africa's KwaZulu-Natal province with about 4 million residents, was experiencing inaccurate water volume readings because many of its meters were either broken or out of calibration. The meters had to be read manually, which led to readings that were dated. As a result, it was difficult for officials to locate water losses, charge accurately, and plan for the future demands of the growing population. To address these challenges, **the municipality collaborated with AWS to develop SHANA**—a municipal data exchange.

SHANA is short for “ukushintshana,” which means “exchange” in Zulu—the primary language in eThekwini. The data exchange is a cloud-based data lake that provides a common location to ingest, store, analyse, and use both public and private datasets. The data lake has several tools available that help manage access and identity. Users can also subscribe to datasets, and a customizable dashboard provides access to analytics to support each user's mission.

SHANA enables eThekwini officials to access the data and analytics needed to manage water operations, resulting in a better understanding of the municipality's water losses and the ability to reduce them. It also allows the revenue management department to track its water purchases independently and supports the development of further sustainability initiatives, such as smart-water metering. With the addition of pipe network mapping and reservoir data, SHANA can identify locations for smart meters to monitor consumption and detect losses. This enables the municipality to develop a proof of concept for new water meter networks, improving the accuracy and completeness of its water data.

“Water is the single most important resource for the people of eThekwini. Quite simply, without it, we die,” said Ednick Msweli, head of Water and Sanitation at the eThekwini Municipality. *“All of us who work to provide water and sanitation feel a tremendous responsibility, and SHANA is already making a difference in our ability to collaborate and succeed in making the most of our scarce water resources. With SHANA, our collective ability to understand exactly how much water we have and how much we are using has increased, as has our confidence in the data we are using to make decisions.”*

Customers as Sustainable Cloud Users

The [AWS Well-Architected Framework](#) helps customers improve their cloud architecture. It consists of design principles, questions, and best practices across six pillars—Operational Excellence, Security, Reliability, Performance Efficiency, Cost Optimization, and Sustainability. The Sustainability Pillar helps AWS customers to structure their cloud architecture to reduce energy consumption and improve efficiency. The framework focuses on helping customers reduce their carbon footprint by integrating sustainability goals, impact measurements, maximized workloads, managed services, and actions to reduce downstream energy use.

AWS also offers the [customer carbon footprint tool](#), so customers can calculate the environmental impact of their AWS workloads. The tool uses data visualizations that lets customers view their historical carbon emissions, evaluate emission trends as their use of AWS's technology evolves, estimate the tonnage of carbon emissions avoided by using AWS instead of an on-premises data center, and review forecasted emissions based on current use.

Accelerated Innovation in Climate Analysis

The [Amazon Sustainability Data Initiative \(ASDI\)](#) seeks to accelerate sustainability research and innovation by helping customers to minimize the cost and time required to acquire and analyse large sustainability datasets. ASDI supports innovators and researchers with the data, tools, and technical expertise to move sustainability to the next level. ASDI currently works with scientific organizations like the National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA) to identify, host, and deploy key datasets through AWS. These include weather observations, weather forecasts, climate projection data, satellite imagery, hydrological data, air quality data, and ocean forecast data. These datasets are publicly available to anyone.

Economic Impact Methodology

To measure the economic impact of data center investments, AWS uses the input-output model developed by Nobel Prize-winning Harvard economist Wassily Leontief. The institutions that also use this model include G20 governments and most blue-chip businesses.⁵

As part of processing the model, a conservative framework is used to define investment and calculate economic multipliers, which represents the “as built” world. The economic impact studies can be directly correlated with what it took, or what AWS is actively planning to do, to construct, connect, operate, and maintain the data centres in a given AWS Region.

Using the value-added approach, AWS calculates the jobs supported by its investments and contributions to gross domestic product locally by AWS and throughout its supply chain. Within the context of AWS methodology, “local” typically describes a country but could also be a smaller division, such as a metropolitan statistical area (MSA), state, or region (for example, Lombardy in Italy). This method uses historical country data maintained by the country’s government statistical agency or the OECD.

Input-output tables show the impact of each unit of currency spent in one industry on all other industries. For example, one U.S. dollar, or approximately ZAR 18, spent on construction might typically be associated with 20 cents, or ZAR 3.6, spent on electricity and other utilities.

AWS also uses Amazon’s internal financial projections on AWS operations and investments tied to constructing and operating data centres. The methodology uses standard procedures for calculating multipliers from the input-output data published by the OECD. See, for example, Ronald Miller and Peter Blair, “[Input-Output Analysis: Foundations and Extensions](#),” 2009, Cambridge University Press.

The cumulative effects of the impact of AWS’s investment on the economy include the following:

- **Direct effect**, which is the change in employment, earnings, and GDP created by AWS’s direct suppliers in a country tied to the AWS investment, such as construction firms, co-location providers, or power companies.
- **Indirect effect**, which is the change in employment, earnings, and GDP created by the indirect suppliers, who supply to AWS’s direct suppliers tied to the AWS investment, such as construction labor and materials.
- **Induced effect**, which is the change in employment, earnings, and GDP created by the firms that supply household goods to workers at Amazon companies and AWS’s direct and indirect suppliers.

⁵ A blue chip is a nationally recognized, well-established, and financially sound company. <https://www.investopedia.com/terms/b/bluechip.asp>

