Access to digital financial services is pivotal for economic empowerment. Yet, millions in developing countries remain financially excluded, limiting their ability to save, invest, and grow businesses. This analysis aims to explore how digital banking and mobile payment adoption can drive economic growth, reduce unemployment and foster inclusive development in three countries: South Africa, Kenya, and Ghana for the years 2011, 2015, 2019, and 2023.

I sort to answer the following Questions:

1. How does digital account ownership correlate with economic growth?
2. What is the impact of mobile banking on employment rates?
3. How do internet access and mobile subscriptions influence inclusion?
4. How does GDP per capita affect access to digital financial services?
5. Are there differences in financial inclusion outcomes between countries with similar unemployment rates but varying digital connectivity?
6. What trends can be observed in financial inclusion from 2011 to 2023 across South Africa, Kenya and Ghana?

Gathered data from the World Development Indicators (WDI) on:

- Mobile cellular subscriptions (per 100 people)
- Individuals using the internet (% of population)
- Account ownership at a financial institution or with mobile - mobile service provider (% age 15+)
- GDP per capita (current US $)
- GDP growth (annual %)
- Unemployment, youth total (% of total labor force ages 15 -24) modeled ILO estimate)
- Population, total
- Urban population (% of total population)

Exported CSV files from the WDI onto google sheets, cleaned the data by:

1. Inspecting the data, checking for missing values in each column.
2. Ensuring that numeric columns are correctly formatted (no text entries).
3. Checked for outliers that might skew the results (giving extremely high or low values).

Discovered missing data for every country for the years 2015, 2019 and 2023 for " Account owners at a financial institution or with mobile - money service provider (% age 15+)

Solved the issue by the following means:

Proceeded to download the missing data from pulling the true account ownership data from the World Bank Global Findex.

Created a reference table in a google worksheet for the missing data. Encountered a challenge, the true set of years in our data is fixed to the following 2011, 2015, 2018 and 2023 but the data retrieved in our reference table (The World Bank Findex data) only consists of the years 2011, 2015, 2017 and 2024.

For 2015, 2019, and 2023 there is no direct data, however we need values for the missing data, instead of leaving them blank or as NULL and only analyzing data for 2011.

Reference table:

reference table
Account Owners _Findex"

Country	Year	Account Owners (%)
Ghana	2011	29
Kenya	2011	42
South Africa	2011	54
Ghana	2014	41
Kenya	2014	75
South Africa	2014	70
Ghana	2017	58
Kenya	2017	82
South Africa	2017	69
Ghana	2024	81
Kenya	2024	90
South Africa	2024	81

Using linear interpolation between the nearest known data points for each country which assumes a steady change between two known data points.

Data points (reference table)
True set years " 2011, 2015, 2019, 2023"
Interpolation calculation:

$y = y_1 + (x-x_1) \times (Y_2 - y_1) / x_2 - x_1$
$= 41 + (2015-2014) \times (58-41) / 2017-2014$
$= 41 + 1 \times 17/3$
$= 41 + 5.67$
$= 46.7 \ (\%)$

etc.
This is a method that assumes a consistent steady change between two known points. It allows us to calculate approximate values for years where no data is available without distorting the overall trend.

Why does it matter?

- Maintains the trend of the data without introducing artificial spikes or drops.
- Provide a complete dataset that can be used for analysis, visualization and comparison.
- Ensures the results are logical and defensible.

Proceeded to create database on MySQL workbench as following:

```
CREATE TABLE financial_data (
    data_id INT AUTO_INCREMENT PRIMARY KEY,
    country_id INT,
    time_id INT,
    account_ownership DECIMAL(5,2),
    financial_institution_usage DECIMAL(5,2),
    mobile_money_usage DECIMAL(5,2),
    internet_access DECIMAL(5,2),
    mobile_subscriptions DECIMAL(5,2),
    population INT,
    unemployment_rate DECIMAL(5,2),
    urban_population_percentage DECIMAL(5,2),
    FOREIGN KEY (country_id) REFERENCES countries(country_id),
    FOREIGN KEY (time_id) REFERENCES time_points(time_id)
);
```
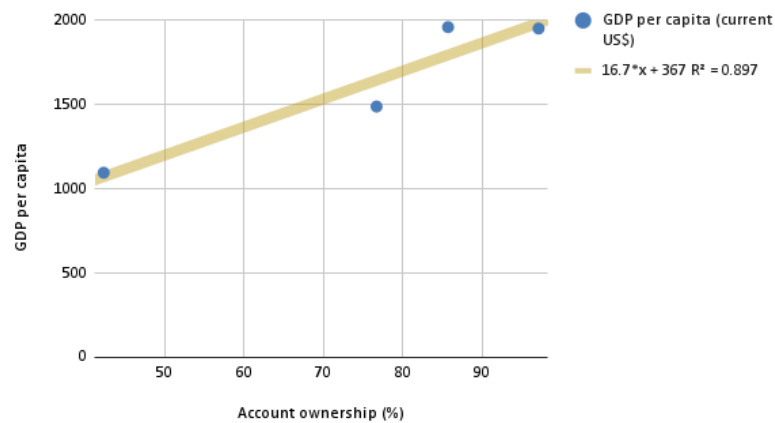
1. How does digital account ownership correlate with economic growth?

A. Correlation and linear regression calculation per country (account ownership vs. GDP per capita), to get a clearer picture of how variables relate within each country.
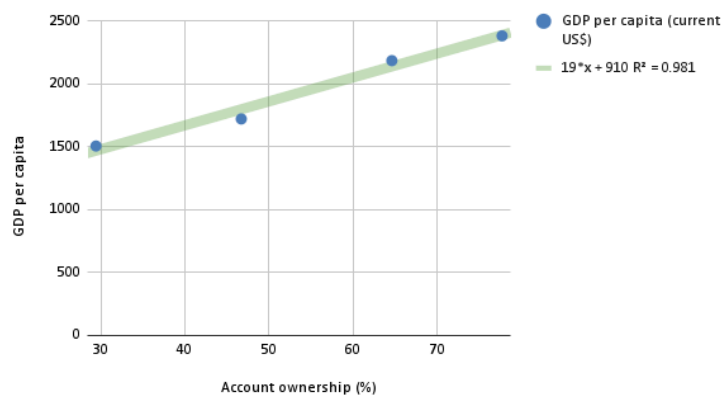
GDP per capita vs. Account ownership (South Africa)

GDP per capita (current US$)

-74.9*x + 11961 R² = 0.602
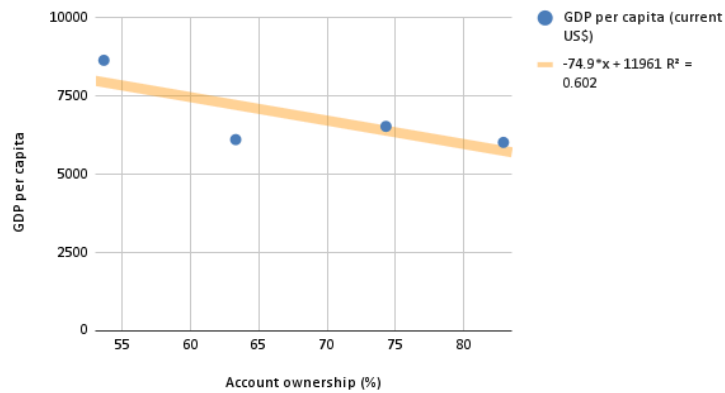
GDP per capita vs. Account ownership (Kenya)

GDP per capita (current US$)

16.7*x + 367 R² = 0.897

GDP per capita vs. Account ownership (Ghana)

GDP per capita (current US$)

19*x + 910 R² = 0.981

Compiled results as following:

Country	Equation	R-Squared	Notes
South Africa	-74.9*x + 11961	0.602	Moderate negative relationship as GDP per capita rises, account ownership tends to decline slightly, suggesting inclusion is not translating into growth
Kenya	16.7*x + 367	0.897	Strong positive relationship, digital inclusion and GDP growth move in the same direction
Ghana	19*x + 910	0.897	A very strong positive relationship, economic growth and financial inclusion are rising together.

In South Africa, higher account penetration does not strongly translate into GDP per capita growth, reinforcing that financial inclusion alone is insufficient without stronger links to the formal economy.

Ghana showed a clearer positive relationship between accounts and GDP per capita, suggesting that even modest growth in financial inclusion is contributing to broader economic gains.

Kenya also displayed a positive association, reflecting how mobile financial services support economic participation and growth.

- Digital account ownership (people having bank or mobile money accounts) can be associated with stronger economic participation and growth, but the relationship varies by country and context and correlation does not = causation.
- Digital account ownership is a necessary but not sufficient condition for economic growth, when paired with active usage, credit access, education, and market linkages, it becomes a powerful driver of inclusion and growth, when used mainly for grants distribution , account counts rise without equivalent economic participation.

**2. What is the impact of mobile banking on employment rates?**

We looked at how account ownership (How many people have bank accounts or mobile money accounts) might be related to unemployment (how many people don't have jobs) using the line of best fit (linear regression) and Correlation calculation per country (account ownership vs

unemployment), to get a clearer picture of how variables relate within each country, which is often more meaningful than lumping all countries together.
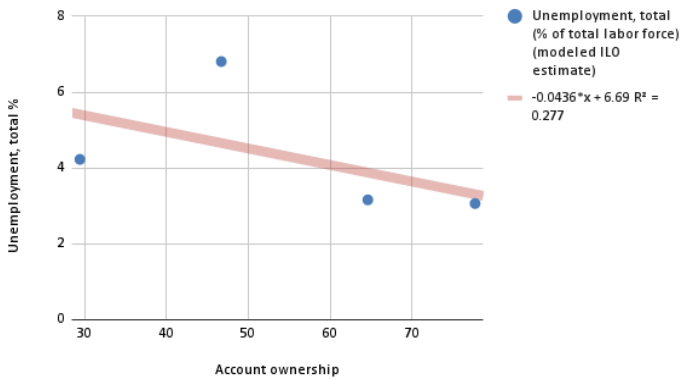
Correlation Strength of Unemployment vs. Account Ownership in South Africa
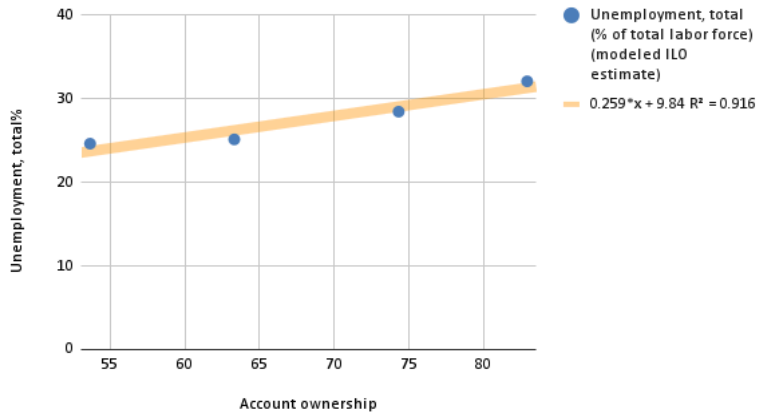
Correlation Strength of Unemployment vs. Account Ownership in Kenya
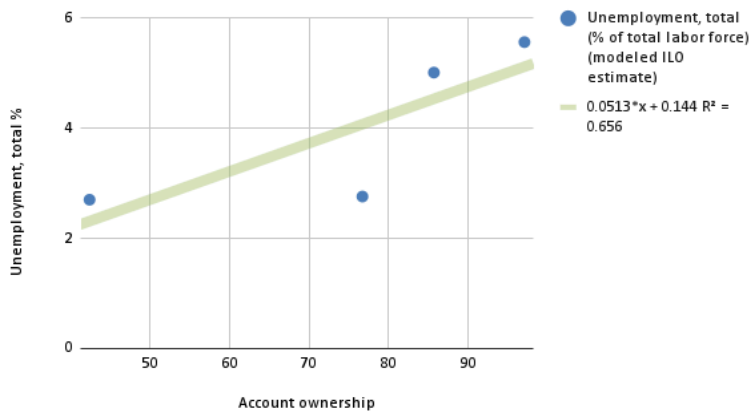
Correlation Strength of Unemployment vs. Account Ownership in Ghana

Compiled results in the following table:

Country	Slope	Intercept	R²	Direction	Notes
South Africa	0.259	9.84	0.916	Positive	Strong positive relationship
Kenya	0.0513	0.144	0.656	Positive	Moderate positive relationship
Ghana	-0.0436	6.69	0.277	Negative	Weak negative relationship

Key Insights:

- South Africa: Strong positive correlation; account ownership seems closely linked with unemployment in the dataset as more people have accounts, unemployment goes up slightly. This variable explains most of the differences we see in unemployment in our dataset.
- Kenya: Moderate positive correlation; the relationship is positive but weaker than South Africa. Moderate link: a small increase in unemployment as account ownership rises. It explains some, but not all of the unemployment variation
- Ghana: Weak negative correlation; account ownership barely explains unemployment variation and shows a slight negative slope. Weak link: account barely affects unemployment. The relationship is slightly negative, meaning more accounts are slightly associated with lower unemployment, but very weakly.

With South Africa having the strongest correlation between account ownership and unemployment could mean:

- More unemployed people opening accounts: It could mean that people who don't have jobs are still opening accounts, maybe to receive social grants, or just to manage their finances better.
- It might also reflect that in times of economic difficulty, more people open accounts to manage whatever income they have, even if they're unemployed.
- A positive correlation doesn't mean it's a good outcome. It just shows a relationship. It could indicate that economic challenges are causing both higher unemployment and more people opening accounts. In this case, even though more people have accounts,

they might not be financially active or able to fully engage in the economy, which can be a challenge for banks and for economic growth.

Let's dig a little deeper to understand why it's happening:

As of 2023, compared to Kenya and Ghana, South Africa's unemployment rate sits at 32%, this adds a layer of complexity.When you have consistently high unemployment, it can affect how people behave differently.

South Africa does have a robust system of social grants, like the child support grants and R370 Social Relief of Distress grant. These grants indeed play a significant role in encouraging people to open bank accounts because it's often the easiest way to receive these payments. That definitely contributes to the higher correlation in South Africa.
In contrast, countries like Kenya and Ghana might not have the same scale or type of social grants, so that could definitely explain why the correlation is weaker or different in those places.

- South Africa: Financial inclusion is high due to grants, but the impact on job creation is limited. Digital accounts here reflect access, not empowerment.
- Kenya: Mobile money platforms show that digital tools can stimulate small-scale entrepreneurship and informal employment.
- Ghana: Weaker correlation highlights the potential for digital accounts to be used as tools for business and growth, independent or unemployment fluctuations.

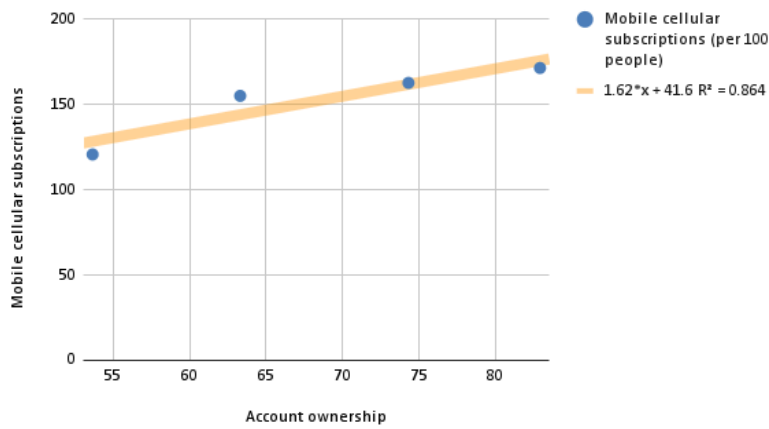**3. How do internet access and mobile subscriptions influence inclusion?**

I want to demonstrate whether and how internet access and mobile subscriptions relate to financial inclusion (account ownership, active usage) in two parts, by calculating the correlation between mobile cellular vs. account ownership and individuals using the internet vs. account ownership.
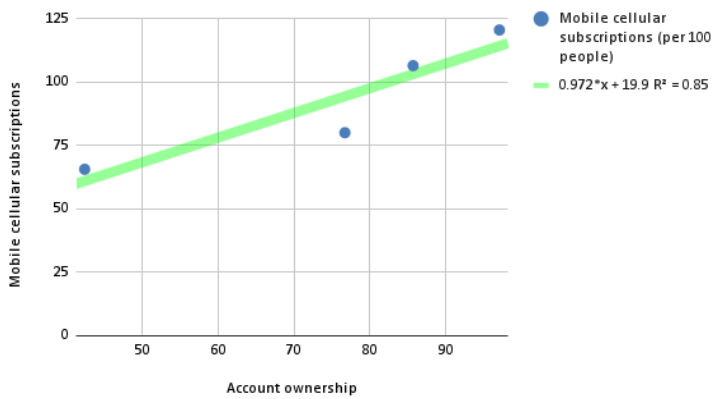Data used:
- Country
- Year
- Internet access (%) — percentage of population with internet access
- Mobile subscriptions (per 100 people)
- Account ownership (%)
- GDP per capita

A. Linear regression and Correlation calculation per country (mobile cellular vs. account ownership

Mobile cellular vs. Account ownership South Africa

Legend:
- Mobile cellular subscriptions (per 100 people)
- $1.62*x + 41.6$ $R^2 = 0.864$

Mobile cellular vs. Account ownership Kenya

Legend:
- Mobile cellular subscriptions (per 100 people)
- $0.972*x + 19.9$ $R^2 = 0.85$

Mobile cellular vs. Account ownership Ghana

Legend:
- Mobile cellular subscriptions (per 100 people)
- $0.437*x + 84.3$ $R^2 = 0.167$
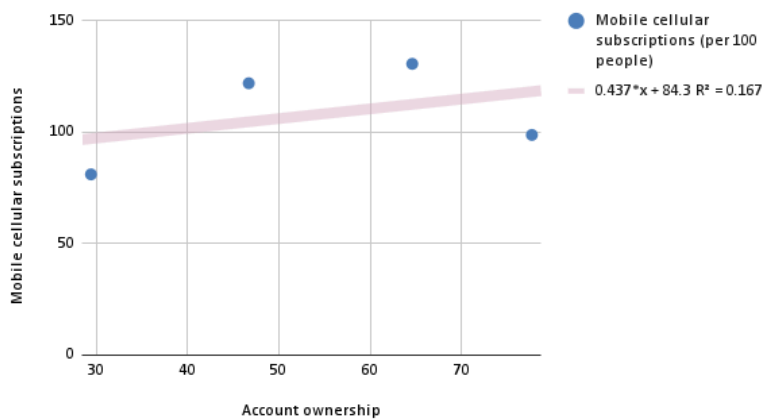
Compiled results in the following table:

Country	Equation	R-Squared	Notes
South Africa	1.62*x + 41.6	0.864	This indicates a strong positive relationship. About 86.4 % of the variation in account ownership can be explained by mobile money usage. This suggests that as more people use mobile money, account ownership increases significantly.
Kenya	0.972* x +19.9	0.85	This also shows a strong positive relationship, with about 85% of the variation explained by mobile money usage. The slope is slightly lower than South Africa's, indicating a less steep increase in account ownership per unit of mobile money usage, but it's quite strong.
Ghana	0.437* x + 84.3	0.167	This shows a weaker positive relationship, with only about 16.7% of the variation explained by mobile money usage. The slope is much lower, indicating that mobile money usage has a more modest impact on account ownership in Ghana.

- South Africa shows the strongest and most impactful relationship, meaning mobile money usage is a significant driver of account ownership.
- Kenya also has a strong relationship, but with a slightly less steep increase in account ownership per unit of mobile money usage.
- Ghana has a weaker relationship, meaning mobile money usage plays a smaller role in driving account ownership.

A. Linear regression and Correlation calculation per country (Individuals using the internet vs. account ownership)

Individuals using the Internet vs. Account ownership South Africa

Individuals using the Internet (% of population)

1.46*x + -41.9 R² = 0.973

Y-axis: Individuals using the Internet
X-axis: Account ownership

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Individuals using the internet vs. Account ownership Kenya

Individuals using the Internet (% of population)

0.43*x + -11.7 R² = 0.843

Y-axis: Individuals using the Internet
X-axis: Account ownership

Individuals using the Internet vs. Account ownership Ghana

Individuals using the Internet (% of population)

1.07*x + -27.6 R² = 0.715

Y-axis: Individuals using the Internet
X-axis: Account ownership

Compiled results in the following table:

Country	Regression equation	R-squared	Relationship strength
South Africa	1.46* x + -41.9	0.973	Very strong positive
Kenya	0.43* x + -11.7	0.843	Strong positive
Ghana	1.07* x + -27.6	0.715	Moderate positive

South Africa

- R-squared = 0.973 means about 97% of the changes in account ownership can be explained by internet usage, that's a very strong link.
- The slope (1.46) means every 1% increase in internet usage corresponds to about a 1.46% increase in account ownership.
- This shows how digital access is a major driver of financial inclusion in South Africa.

Kenya

- R-squared = 0.843 shows a strong positive relationship, 84% of account ownership variation is explained by internet use.
- The smaller slope (0.43) means the effect is positive but less steep than South Africa's, so internet growth helps, but not as dramatically.
- Kenya's already high baseline of account ownership(thanks to mobile money systems like M-Pesa) likely explains the gentler slope.

Ghana

- R-squared = 0.715 means 71% of account ownership changes are linked to internet access, still meaningful but weaker than the other two.
- The slope (1.07) shows a moderate increase: for every 1% rise in internet use, account ownership rises by about 1.07%
- This suggests digital access matters, but other factors (like income levels or financial literacy) might limit the impact.

Internet penetration strongly influences financial inclusion, but the degree of impact differs by country.
South Africa's financial ecosystem benefits most directly from digital connectivity.
Kenya's inclusion story is already shaped by mobile money dominance, the internet helps, but not as sharply.
Ghana's growth shows progress, though digital inclusion may still face barriers.

Broader consideration:

- Informal Economy:
  - In all three countries, informal businesses and hustles form a significant part of livelihoods. Many use digital tools to receive payments and manage money, even without formal jobs.
- Digital Literacy:
  - Access alone is not enough, without skills to use digital platforms meaningfully, people may remain excluded from true economic participation.
- Data accuracy:
  - As informal workers adopt digital platforms, their economic activities become more visual, improving policymaking and national statistics.

Financial access alone ≠ economic growth.

- South Africa shows that if accounts are used mostly for social grants, financial inclusion doesn't directly lower unemployment or raise GDP per capita.

- Ghana and Kenya suggest that when accounts are tied to active economic activity (savings, payments, remittances), the link to growth and lower unemployment is stronger.

4. How does GDP per capita affect access to digital financial services?

Countries with higher GDP per capita tend to have higher digital account ownership and mobile/internet usage.
- South Africa has the highest GDP per capita among the three and also shows the highest digital account ownership and mobile/internet penetration.
- Ghana with the lower GDP per capita than South Africa but higher than Kenya in some measures, shows moderate digital account ownership.
- Kenya, with the lowest GDP per capita, shows lower levels of digital account ownership relative to its population, though mobile use is still significant due to mobile money services.

Higher GDP per capita often indicates better infrastructure, financial literacy, and access to technology, which facilitates digital financial inclusion. Conversely, countries with lower GDP per capita face more barriers to adopting digital financial services.
While GDP per capita is a strong predictor, other factors like mobile network reach, government policies, and financial inclusion initiatives (e.g mobile money in Kenya) can also drive digital account ownership independently of GDP.

5. Are there differences in financial inclusion outcomes between countries with similar unemployment rates but varying digital connectivity?

I have observed that countries with similar unemployment rates can still show different levels of financial inclusion (account ownership and mobile money use) if their digital connectivity differs. For example, a country with moderate unemployment but higher internet or mobile penetration tends to have higher account ownership and mobile financial services use.

Conversely, a country with similar unemployment but lower digital connectivity has lower financial inclusion outcomes, even though the economic pressures (unemployment) are similar.

Digital connectivity acts as a multiplier for financial inclusion, access to mobile networks and the internet can compensate for other economic barriers like unemployment.

Unemployment alone is not the sole determinant, digital access significantly influences whether people can participate in formal or mobile financial systems.

6. What trends can be observed in financial inclusion from 2011 to 2023 across South Africa, Kenya and Ghana?

Over the period from 2011 to 2023, I observed notable growth in financial inclusion across South Africa, Kenya, and Ghana.

- Kenya demonstrated the most significant increase, with account ownership rising from 42% in 2011 to 97% in 2023. This rapid growth was largely driven by the widespread adoption of mobile money services like M-PESA.
- South Africa also saw a steady upward trend, from 54% in 2011 to 83% in 2023. The country's growth reflects improved digital banking infrastructure and broader access to formal financial services.
- Ghana experienced more gradual, yet consistent growth, moving from 29% in 2011 to 78% in 2023. Although the growth rate was slower compared to Kenya, mobile money adoption played a crucial role in enhancing financial inclusion.

All three countries made significant strides in increasing financial inclusion, with digital and mobile financial services being key drivers of this growth.

While digital account ownership has expanded significantly across South Africa, Kenya, and Ghana , its relationship with unemployment varies. South Africa's strong link reflects reliance on grants, Kenya's moderate link shows promise through mobile money ecosystems, and Ghana's weaker link highlights entrepreneurial use.

For digital inclusion to translate into economic empowerment, both policy makers and businesses must go beyond access, investing in literacy, tailored financial tools, and opportunities that bridge informal and formal economies.

Financial inclusion on its own is not enough. South Africa demonstrates that widespread access to accounts may still coincide with unemployment and stagnant growth if accounts are not used productively.In contrast, Ghana and Kenya highlight that when account ownership is connected

to economic activity, entrepreneurship, and financial services, it can contribute meaningfully to growth.

Recommendations:

For policy makers:

- South Africa: Complementing grants with job creation programs that help beneficiaries transition into sustainable work or entrepreneurship.
- Kenya: Strengthen mobile money ecosystems by linking them with credit access, micro-insurance, and business growth tools.
- Ghana: Build on entrepreneurship use of account by expanding SME financing and integrating more informal businesses into formal structures.
- Enhance digital infrastructure, invest in expanding internet connectivity and mobile network coverage, particularly in rural and underserved areas, to ensure more people can access digital financial services.
- Develop and implement policies that foster a secure and inclusive digital financial ecosystem, including consumer protection and data privacy.
- Launch educational campaigns to boost financial literacy, helping individuals understand and use digital financial tools effectively.

For businesses and Fintech:

- Inclusive Products:
    - Design low-free accounts, savings tools and microloan products tailored for informal workers.
- Education & empowerment:
    - Invest in digital and financial literacy campaigns so users can maximize these tools.
- Market access:
    - Build platforms that connect small businesses and informal workers with wider customer bases.
- Long term,
    - encourage integration between informal and formal economies by making digital platforms stepping stones for small businesses.
- Use digital transactions to generate better economic insights, leading to stronger more inclusive policy frameworks.
- Develop tailored financial products that cater to the needs of diverse populations, especially in rural areas, and leverage mobile banking to increase accessibility.
- Collaborate with telecom companies and fintech startups to expand reach and improve service delivery.
- Focus on reaching marginalized groups, such as women and low-income populations, ensuring that digital finance benefits everyone equitably.