Can the use of machine learning techniques on financial inclusion dataset in Eswatini be a game changer?

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Abstracts

Lack of data-driven intelligent applications for re-engineering financial inclusion and for determining an individual's or a country's Financial Inclusion (FI) status in real-time is a barrier. To harness the power of machine learning predictive models to build a sustainable society and inclusive economy in the Kingdom of Eswatini, it is imperative to align the Eswatini financial inclusion strategy with the financial inclusion framework based on the recommendation of Alliance for financial inclusion (AFI). It is when the alignment is properly done that we can develop a reliable and dependable financial inclusion (FI) scheme for citizens and businesses to improve access to financial services and contribute to economic growth. Most households in local communities do not have a bank account so the government needs to come up with a policy to encourage a cashless society that will also give room for credit accessibility and use of the financial institution. Machine learning algorithms are a game changer because it can tremendously assist policymakers, individuals, countries and financial service providers with effective ways of providing and managing financial services across different population groups to ensure inclusive participation, economic growth and financial inclusion. This can also help regulators make informed decisions on financial inclusion and monitor the financial inclusiveness of various households in the four regions of Eswatini.

Keywords: Financial Inclusion, Machine learning, Eswatini second National Financial Inclusion Strategy, potential impacts, FinTech integration

Introduction

The financial sector mostly in emerging nations classified as level 1 such as China, Indonesia, Brazil, Mexico and so on has increasingly utilized analytics to address economics difficulties (Barua et al., 2024). Recent studies by Fashoto et al., (2023), Dlamini et al., (2023) and Akinnuwesi et al., (2020) highlighted the revolutionary potential of applying and integrating machine learning and deep learning techniques into financial decision-making process in the Kingdom of Eswatini. There is already evidence as reported in the Eswatini second National Financial Inclusion Strategy (NFIS II) that formal financial inclusion improved from 53% in 2011 to 87% in 2023 (NFIS II, 2024).

The application of machine learning (ML) models on financial inclusion datasets in the Kingdom of Eswatini could be a groundbreaking approach depending on the quality of the datasets used to address the challenges facing the Kingdom. These challenges could be conducive environment, access and usage of financial services which are key factors of financial inclusion as reported in Eswatini National Financial Inclusion Strategy (NFIS) (NFIS II, 2024). For re-engineering to have long-term effect in the financial inclusion system in the Kingdom of Eswatini in regard to SDG-9 goal which aimed to foster innovations and build resilient infrastructure, the use of data-driven intelligent models deserve critical consideration to foster the creation of an innovative and inclusive financial system to promote sustainable economic growth for Emaswati.

Below are the potential impacts and the challenges of machine learning algorithms as a game-changer in the Kingdom of Eswatini.

2.0 Potential Impacts of ML as a game-changer on Eswatini dataset

1. **Data Quality issues resolution:**
    - **Class imbalance**

In a study conducted by Mbunge et al. (2024) on financial inclusion dataset on Eswatini, class imbalance was eliminated using synthetic minority oversampling technique (SMOTE) approach to improve the data quality.

- **Missing data**

Fashoto et al. (2023) study on 2018 FinScope dataset in Eswatini has a lot of missing data which affect the performance of the machine learning model. In the study data imputation approach was used to replace the missing data with the mode method to improve the practical impact of the ML model. It should be noted that data collection and data pre-processing are time-consuming and expensive.

2. **Improved Credit Risk Assessment**:

According to a study by Akinnuwesi et al. (2020) ML model has a higher prediction accuracy to predict a credit risk from a lender to underserved groups compared to the use of a conventional financial metrics approach. The outcome of this finding can act as a booster to financial inclusion in the Kingdom of Eswatini.

3. **Identification of Region in Eswatini lagging financial inclusion**

Based on the survey dataset from Finscope on Eswatini financial inclusion dataset 2018 (Fashoto et al. 2023), the application of machine learning shows that three regions are lagging on financial inclusion and the regions are HhoHho, Shiselweni and Lubombo. It was recommended, based on the findings that special attention should be given to the Lubombo region by the government.

4. **Increased Research output and Application**:

Before the year 2020, there was no study on the application of data-driven machine learning techniques on Eswatini financial inclusion dataset which limit the knowledge base. Currently, there are four papers on the application of machine learning and deep learning techniques on financial inclusion dataset of Eswatini ((Mbunge et al., 2024, Fashoto et al., 2023, Dlamini et al., 2023 and Akinnuwesi et al., 2020).

5. **Enhanced small scale businesses Financial Access**:

Akinnuwesi et al. (2020) and Fashoto et al. (2023) studies showed the impact of using machine learning algorithms for analysis of the Eswatini Finscope dataset of 2018 that contains 1385 variables and 2928 records. The ML techniques used were support vector machine (SVM) and logistic regression to identify the barriers to financial access by small scale businesses (SSBs) such as payment channels, income sources and bank usage. The findings in these studies could act as a catalyst to guide how to foster investment, increase capital base and job creation which is one of the emphases of the recent NFIS II from the Ministry of Finance for 2023 to 2028 (Fashoto et al. 2023).

6. **Insight into Policy and Governance on financial inclusion**:

According to Dlamini et al. (2023), the study recommends the use of deep learning techniques on financial inclusion dataset in countries like Eswatini, Rwanda, Namibia and Madagascar. This study identifies the main predictors through the use of CatBoost algorithm on the financial inclusion dataset in three countries (Eswatini, Rwanda and Madagascar) to be spending and income, quality of financial services and remittances while the top three predictors for Namibia are bank penetration, general and money management and risk through the use of the random forest algorithm for the financial inclusion prediction. The alignment of the findings by Dlamini et. al., (2023) with Fashoto et al., (2023) will assist policymakers to prioritize high impact communities.

Machine learning algorithms also help to reveal hidden patterns in Eswatini financial dataset without much effort from a regional perspective, cash payments dominance vis-a-vis bank usage. Fashoto et al. (2023) recommend that this outcome can assist Centre for Financial Inclusion (CFI) under the Ministry of finance to make an informed decision on the need for digital financial services to reduce citizen overreliance on cash transactions.

7. **Machine learning Driven FinTech Integration**:

The Eswatini FinTech working group (EFWG) was formed in year 2020 in Eswatini to promote engagement between regulators, innovators, financial services providers and policymakers on financial inclusion to improve productivity and reduce efficiencies in the financial space. One of the mandates of EFWG, (an initiative of the Central Bank of Eswatini Fintech unit) was to create awareness on the use of machine learning approaches to drive financial technology (FinTech) solutions. The use of ML will also help by circumventing formal credit registries which is more needed in the kingdom of Eswatini where less than 50% of the citizens use commercial banks and more than 50% use mobile money to improve financial inclusion. As a result of the above EFWG started giving support to IndabaX Eswatini to augment the funding they are receiving from deep learning indaba to strengthen the machine learning community in 2022. The 2022 edition indabaX theme was Application of machine learning models on financial inclusion. Since 2022 till date, IndabaX Eswatini has been part of the project of EFWG.

8. **Poverty Reduction and Economic Growth**:

According to Akinnuwesi et al. (2020) the use of machine learning models on Eswatini financial inclusion dataset showed that access to credit by SSBs and low-income earners can improve Emaswati income and reduce poverty which is one of the targets of the government as stated in the NFIS II 2023 to 2028.

3.0 Problems and shortcomings of Machine Learning

Implementation Barriers:

The cost of machine learning infrastructure such as graphics processing unit (GPU) and cloud services for an emerging and resources limited nation classified in level 2 like Eswatini is a huge concern. Additionally, scarcity of machine learning or AI skills experts is a concern. According to Eswatini Ministry of Finance report 2023, overreliance on cash and low bank patronage is an indicator that there is a need for digital infrastructure. This will ease machine learning transformation in the financial

inclusion ecosystem. This is the key driver of the Ministry of ICT to fully support the digital transformation initiative in the Kingdom of Eswatini.

Generalization:

According Dlamini et al., (2023), generalization is an issue with country specific datasets especially in Eswatini due to limited diversity, bias in data collection, dataset variability, missing values and different feature distributions. This study found CatBoost algorithm result was outstanding on predictors such as remittances and financial services quality based on the dataset from three countries (Rwanda, Eswatini and Madagascar) but this finding cannot be generalized on the continent or the world at large.

4.0 Relevance of ML techniques on financial inclusion dataset of Eswatini

Some of the machine learning techniques used thus far such as support vector machine and logistic regression have a success rate that is not optimal for solving classification problems due to low data quality. Ensemble machine learning used on Eswatini financial inclusion dataset has shown the ability to resolve class imbalance and improve prediction accuracy.

5.0 Conclusion and Recommendations

There is a big hope that the application of machine learning techniques on Eswatini financial inclusion dataset has the potential of being the game-changer in the financial landscape on how data-driven insight can improve credit access, assist governance in making an informed decision and minimize poverty in the Kingdom of Eswatini. However, limited number of research output, low data quality and high cost of implementation is a hindrance.

To achieve the potential of machine learning in the financial inclusion ecosystem, the government, the Ministry of finance, Centre for financial inclusion and the EFWG would need to do the following

- Address the issues on data quality such as missing data, class imbalance, insufficient data, noisy data, ambiguous data and bias data.
- Invest in digital infrastructure to improve the usage of mobile money and bank
- There is an urgent need for government-private partnerships to fund machine learning initiative on financial inclusion

I have a strong belief that if all the three concerns above are addressed, then the impact of machine learning as a game-changer will be highly momentous.

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