

# Technology Evolution and Tax Compliance: Evidence from Rwanda

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Summary of African Tax Administration Paper 30

## Using technology to narrow the ‘information gap’

Data on economic transactions is crucial for tax administrations to be able to enforce tax compliance, and technology can be key to obtaining information. In the last decade, African tax administrations have increasingly adopted technological advances such as integrated systems, electronic filing, and electronic billing machines (EBMs). EBMs allow taxpayers to digitise their transactions and transfer billing information automatically to the revenue authority. They have high potential, as they allow firms to lower their administrative and compliance costs, streamline transactions, improve record-keeping, strengthen their administrative capacity and, in the case of small businesses, improve their ability to attract clients and engage in trade thanks to improved accuracy and transparency.

Rwanda is one of Africa’s fastest growing and most technology-oriented countries. The government is highly reliant on technology to improve tax revenues. In 2013, the Rwandan Revenue Authority (RRA) introduced EBMs through a machine called EBM1. This used a SIM card, through which VAT-registered taxpayers transmitted sale transaction data to the RRA in real time. Like any technology, there were practical challenges, such as the cost of acquiring and maintaining the machine, limitations in storing information and lack of remote support. As a result, an improved, free, software version called EBM2 was rolled out in 2017 and is still in use. This can digitise and store receipts, capture core business information like inventory and type of items sold, automatically validate buyers’ identity and provide support online.

This paper evaluates the impact of the implementation of EBM2 on VAT and income tax compliance. Thanks to a collaboration with the RRA, we looked at around 60,000 EBM users’ monthly/quarterly VAT and annual income tax returns from 2013 to 2020. We focus specifically on two groups: those who had previously used EBM1 and shifted to EBM2 (shifTERS), and those who only adopted EBM2 (new users). Taking advantage of the fact that EBM2 adoption happened over time, we conduct a difference-in-difference strategy to estimate the impact of EBM2 on key outcomes for both VAT and income tax, including the discrepancy in reported turnover between the two tax heads.

## How effectively can EBMs improve tax compliance?

Regarding the VAT reporting of new users of EBM2, we find that adoption causes a significant increase in most VAT return items. Turnover significantly increases by about 30 per cent, and, in parallel, the VAT on sales rises as well. Final VAT due therefore increases too. These results show that EBM2 is quite effective for new users, who likely benefit from adopting the technology for the first time.

The impact of EBM2 on those who shifted to EBM2 from EBM1 is more muted. We believe this weaker impact is likely to be because of their familiarity with EBM1, which is essentially a different version of the same technology.

Regarding income tax, impacts on the probability of filing on time, turnover and final tax payable are reduced. This more mixed impact is largely driven by new users. The impact of EBM2 on income tax compliance remains inconclusive since the results are not robust.

Finally, we estimate the impact of EBM2 on reporting accuracy. We find that EBM2 adoption widens the discrepancies between VAT and income tax returns. This happens especially as the probability of reporting the same turnover across tax heads is reduced. The fact that new users file more accurately for VAT and less so for income tax could be explained by the misperception that the RRA monitors VAT more closely than income tax, thanks to EBM2.

## How do different taxpayers react to new IT solutions such as EBM2?

Because different taxpayers can respond differently to IT solutions, we compare taxpayers by sector, location, and size. When it comes to firm sectors, manufacturing firms increase turnover after adopting EBM2, as do trade and construction firms. Not surprisingly, regarding firm location, there is more impact in the capital, Kigali, with users there significantly increasing their turnover and final VAT due compared to those in the provinces.

When analysing firms by size, there is a backfiring effect from medium and large taxpayers, especially on VAT paid

on inputs and final VAT liability. When it comes to new users, small taxpayers report higher turnover and final VAT due. The results suggest that the RRA's attention should be focused on two groups: larger taxpayers, who are more tax-savvy and can probably be more creative when it comes to tax avoidance, and rural taxpayers, who, due to a lack of knowledge, might not be reaping all the benefits from EBM2.

## Conclusions and policy recommendations

Overall, we find that advanced IT solutions, like EBM2, can effectively increase tax revenue and compliance. This is particularly true for VAT, while more attention should be devoted to the spillover effects on income tax. The diffusion of EBMs holds big promises and lessons for both the RRA's tax administration and other tax administrations in the region.

- There are two main policy takeaways. First, the strong, consistent, effect of EBM2 on new users indicates that adoption should be encouraged for the large numbers of new registrations every year. This is in line with what the RRA is already doing, in the context of its *EBM for all* policy. Such evidence also suggests that voluntary compliance could be better shaped through technology, acting as a complement to costly audit strategies, especially for new entrants, usually

smaller in size. For shifters, who are larger and more sophisticated entities, more traditional audit strategies could complement technology to improve compliance.

- Second, the mixed effect on discrepancies between VAT and income tax calls for further caution. Transaction data from EBM2 could be more directly used to improve income tax declarations. This more holistic approach to monitoring compliance across different tax heads, coupled with adequate taxpayer education, could improve compliance with income tax as well, on top of the benefits already accruing to VAT.

**“More sophisticated electronic billing machines greatly improve VAT compliance, especially for new users. This technology, combined with traditional audits and education programmes for targeted taxpayer categories, could further enhance income tax compliance too.”**

**Note:** This is a revised version of [Technology Evolution and Tax Compliance: Evidence from Rwanda](#), ICTD Research in Brief 99, originally published in September 2023.

## Further reading

Hakizimana, N. and Santoro, F. (2023) [Technology Evolution and Tax Compliance: Evidence from Rwanda](#), ICTD Africa Tax Administration Paper 30, Brighton: Institute of Development Studies, DOI: [10.19088/ICTD.2023.033](#)

## Credits

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**Citation:** Hakizimana, N. and Santoro, F. (2024) *Technology Evolution and Tax Compliance: Evidence from Rwanda*, ICTD Research in Brief 99, Brighton: Institute of Development Studies, DOI: [10.19088/ICTD.2024.038](#)

ICTD is proudly funded by

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