



## ICT TO ENHANCE WAREHOUSE RECEIPT SYSTEMS AND COMMODITY EXCHANGES IN AFRICA

### INTRODUCTION

This is one of a series of briefing papers to help USAID missions and their implementing partners in sub-Saharan Africa use information and communications technology (ICT) more successfully—via sustainable and scalable approaches—to improve the impact of their agriculture related development projects including Feed the Future projects.<sup>1</sup> This paper provides a brief overview of the fundamentals of warehouse receipt systems (WRSs) and commodity exchanges (CEXs), describes several ways in which ICT tools are being mobilized, and captures key lessons learned with a focus on sustainability without donor support. It is not focused on assessing the general impact of WRSs and CEXs for smallholder farmers, but rather, the use of ICT for such systems.

In the last 50 years, the landscape for trading commodities globally has radically changed. Before revolutions in mobile communication and ICT, markets were only loosely integrated. Trading was based on proprietary information acquired through trips to distant countries and building relationships with key informants. Today, screens around the world reflect trading transactions almost instantaneously whether physical commodity, stocks, shares or currency rates. The daily price of traded maize futures on South Africa's SAFEX (commodity exchange) is fully integrated with the traded price of maize futures on the Chicago Board of Trade. The global nature of trading has also changed;

<sup>1</sup> ICT includes cell phone and Internet services, radio, and a wide range of digital devices and related tools including cameras, geographic information systems, and a wide range of hand-held computing devices.

speculative international physical traders have greatly reduced in numbers as access to information has eroded their advantages. At the same time, speculation by outsiders (e.g., hedge funds) in commodity markets through commodity exchanges has increased significantly. For every metric ton that is delivered onto the exchange in SAFEX, 25 times more contracts are bought and sold speculatively. The staple food spikes in 2008 were driven to a large extent by outside speculators and did not reflect the physical reality of stocks.

ICT has facilitated these changes both positively and negatively. However, these markets were already trading on stable building blocks. It is therefore *critical* for donors and development practitioners in sub-Saharan Africa to consider *whether and, if so, how* to intelligently support the integration and utilization of ICT in warehouse receipt systems and commodity exchanges.

In general in Africa, smallholder farmers farming very small parcels of land use basic agricultural techniques to produce staple crops. Each farmer has a very small surplus. Generally farmers sell in a local market or from their farm gate when a small trader passes by. These small volumes are collected by traders using bicycles, ox carts or pick-up trucks. These volumes are brought to the nearest small storage point and kept generally in poor conditions before being collected by the next trader up the supply chain. For some crops, the next level of trader provides some conditioning – generally limited to reducing moisture content. The commodity is stored in fairly poor conditions before being sold onward to wholesale traders, who then sell either to

processors or to the traders which services the consumer markets. The majority of trade in Africa is turnover trade—very low margins per unit, but many units. With some exceptions, it is characterized by poor storage, inexact standards, no contracts, and no finance. Post harvest loss due to spoilage is generally high.

### WRS AND CEX IN AFRICA

Understanding the fundamentals of WRSs and CEXs is important when deciding if one or both are critical for the development of a specific agriculture sector and whether they require any ICT support.

CEXs and WRSs are built on a number of building blocks essential for either system to function sustainably: standardized grading and weights, standardized storage facilities, professional storage management, suitable insurance products, enforceable contracts and market intelligence. Both systems can function without ICT—or minimal ICT—as long as volumes are low. A WRS is usually a building block for a CEX.

*Warehouse receipts* are paper or electronic documents of title which stipulate the commodity, quality grade, location and ownership of the commodity deposited in the warehouse. The receipts can be transferable or non-transferable. Transferable warehouse receipts allow whoever has access to the title to transfer its ownership to someone else. A non-transferable title must go through a particular process often controlled by a regulator to transfer ownership. Warehouse receipts are generally issued by regulator-

certified warehouses, and their issuance, handling, liens, and cancellation are managed by systems overseen by the regulator. The receipts can be used in a commodity exchange, enabling buyers and sellers to conduct transactions using the receipts to represent the physical goods, which can remain in warehouses and are moved only after the transaction is completed.

ICT is a recent tool for WRS, being primarily employed to improve transaction speed and allow for 24 hour trading. As transaction volumes increase, ICT becomes more valuable.

In Africa, almost all of the storage between harvest and when the staple crops are consumed is financed by farmers and the myriad traders and processors holding stock. This involves vast amounts of capital; in Kenya alone the harvest value of the main staple crops is over \$750 million; Kenya, Uganda, and Tanzania's average maize harvest has a value of over \$1 billion. This capital cost is tied up month after month until it is sold to the consumer. Without finance, the companies that buy or own stocks of commodities are constrained by tying up their capital in these stocks. Properly managed warehouse receipt programs provide a regulated instrument that allows financial institutions to advance loans against the receipts with the commodity as collateral, freeing up the capital held in the system. This is a key benefit of warehouse receipt systems.

Even though the WRS may not directly help smallholder farmers, there are a number of important indirect benefits. With a WRS, financing becomes more available so there is more money to buy the commodity from the farmers, which increases the number of times the traders can go back into the market to purchase grain, increasing competition and generally reducing the sharp drop of prices at harvest. If the smallholder farmer can meet the minimum conditions for a deposit to a warehouse (either individually or in a group), she or he can delay selling their commodity, waiting for prices to increase, and still

provide for immediate cash needs through financing the warehouse receipt.

The term “*commodity exchange*” covers a range of structured market configurations including physical market places; however in modern parlance the concept has come to mean an electronic platform where buyers and sellers interface through registered brokers to trade multiple lots of different commodities. The standardized contracts traded specify quality, quantity, and sometimes location. Depending on the sophistication of the market or exchange, the contracts will include spot price, forward, futures, and options contracts. Brokers are used as exchange licensed intermediaries who guarantee the performance of the buyer and/or the seller of a contract. Generally buyers and sellers will have provided the broker with financial guarantees that underpin their performance. Most exchanges have a specified lot size (e.g., 100 metric tons). At the end of any particular trading period (e.g., three months), the sales and purchases are reconciled; most cancel out and the remainder is concluded through delivery of warehouse receipts (paper or electronic) from acceptable registered warehouses. The owner of the receipt then arranges for collection from the stated warehouse, or sells it back onto the exchange to another buyer.

Most exchanges carry out significantly more transactions than there is real commodity in the market. Some exchanges, such as ACE in Malawi, have no underlying guarantee of commodity and therefore no official confirmation of quality and volume. Offers and bids are based on trust that the commodity is really there and of the quality stated, with the broker taking the risk that both buyer and seller are legitimate. Generally this type of exchange has failed to achieve high volumes in Africa.

Ownership structure of an exchange ranges from those entirely owned and supported by the private sector (e.g., SAFEX, which began with 84 members each paying Rand 50,000 to join), to those that are government-owned (e.g. UCE,

Uganda Commodity Exchange).<sup>2</sup> There are variations, such as the Ethiopian model, which is government-owned, but sells membership seats on an annual basis (the most recent price was an average of Birr 210,000 per seat).<sup>3</sup>

### **Current systems in Africa:**

Warehouse receipt systems and commodity exchanges are more prevalent in east and southern Africa than in west or central. There are currently operational warehouse receipt systems or inventory finance systems in Kenya, Uganda, Ethiopia, Tanzania, South Africa, and Madagascar. Several West African countries utilize warrantage/inventory credit (Ghana, Burkina Faso, Niger, Senegal) and *contrats de tierce detention* (Mali).<sup>4</sup> Initiatives to launch warehouse receipt systems are in process in Ghana and Nigeria. Commodity exchanges—or at least entities labeled as commodity exchanges—include ACE in Malawi, ASCE in Nigeria, ECX in Ethiopia, SAFEX in South Africa, UCE in Uganda, and ZAMACE in Zambia. There are also efforts underway to launch a national commodity exchange in Khartoum, a West Africa Commodity Exchange based in Accra, and a Pan-African exchange based in Gaborone. As of November 2010, there is also an effort under way to establish a regional commodity exchange in east Africa facilitated by Kenya's National Cereal and Produce Board.

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<sup>2</sup> Approximately \$18,000

<sup>3</sup> Approximately \$16,300

<sup>4</sup> Warrantage in its simplest form is depositors (farmers) storing their commodity alongside other depositors (farmers of the same group) in a small general store. These systems have extended to include inventory credit, which is the financing of a proportion of the commodity's value in the store. Often the financier, the store owner, and the farmer group representative will each control a key to one of the padlocks on the door and therefore control the movement of the commodity from the store. In Mali the 'tierce detention' (third party holding) worked in a similar manner with the banks controlling the release of traders' goods stored in a third party warehouse.

## HOW ICT CAN HELP

The primary use of ICT in WRSs and CEXs has been to shift from paper-based administration to electronic systems and to accommodate 24 hour trading. This speeds transaction times (which under a paper-based warehouse receipt model can take up to 14 days to transfer ownership of a warehouse receipt), and, with significant volumes, can reduce back office administration costs. Using ICT can also allow far-flung traders to participate in a CEX. Of the roughly six WRSs in sub-Saharan Africa, only Ethiopia, Uganda, and South Africa use electronic receipts and link to CEXs, however Ghana and Kenya intend to invest in electronic systems.

**1. Software:** Software applications developed for CEXs range from linked financial spreadsheets to more complex software. Software can be “off the shelf” (meaning developed for and used by many customers) which is then adapted (e.g. ACE); custom developed (e.g. UCE) or a combination of the two approaches. Either way, cost estimates start at about \$80,000. Most of the software engineering expertise has been sourced from either South Africa (e.g., Sandbox Projects, which designed software for SAFEX and UCE) or outside of Africa. ECX developed their system locally and ACE is using local talent to develop the additional World Food Program (WFP) ICT platform link between ACE and ZAMACE.

ACE actually supported its initial successful WFP purchase using a simple spreadsheet projected onto a screen so all bidders and the WFP representative could see it simultaneously. Bidders wrote their bids on paper forms, handed them to the ACE representative to review, and then they were passed to the person updating the spreadsheet. This is an example of how a little technology can be used to help new trading mechanisms get started and have a significant impact on bidders. Before this, WFP used a closed paper tender process (with additional restrictions on bidders) and no sellers could improve their bids based on seeing what competitors were bidding. The biggest

weakness of this basic ICT approach was that it was next to impossible for bidders elsewhere to participate in the process.

WRSs use software to manage a secure interface between the issuer of the warehouse receipt, the owner of the receipt and the financial institution holding a lien on the receipts, and the transfer to buyers.

**2. Telecommunications:** WRSs that use electronic receipts use the Internet to transfer title documents to owners, banks, buyers and, where required, to a central registry that records issuance, cancellation, transfer of ownership, liens for financial transactions, and stock reconciliation by location.

Exchanging such electronic transactions does not require broadband Internet access so it can be done using relatively cheap data exchanges via cell phone networks, most of which provide access to the Internet today. Given the chances of losing connectivity, any system needs to have built-in safeguards to confirm any data exchanges have been completed successfully (a standard process for robust telecommunications dependent software applications).

Exchanges can also use SMS (text messaging via cell phones) to offer information—essentially market price information—to traders or producers in far flung locations. For example, Kenya’s WRS uses SMS to communicate with the warehouse receipt owners to register warehouse receipts with the regulator. ECX in Ethiopia uses SMS codes to disseminate price information. At the moment these systems are simple and not designed to push information to users based on users’ profiles. An efficiently working, high volume commodity exchange will result in standardized pricing information that can feed back into the market. Other than SAFEX, exchanges in Africa are not yet trading sufficient volumes of staples to offer an effective price discovery system.

All of the CEXs in Africa have websites, but these are not used to conduct business. Online access does provide

traders far from the CEX “real time” (or near real time) reporting of bids, offers and traded prices for any particular commodity. ECX in Ethiopia also provides electronic feeds of traded prices in markets around the country. Access to the trading platforms is through different types of brokers who may be accessing the system virtually or in physical “pits” at exchange locations where different brokers buy and sell from each other on behalf of their clients.

**4. Radio and television:** Radio and television can be useful tools to raise awareness of both CEXs and WRSs, such as how to work with these new market institutions and to disseminate traded prices by commodity. UCE uses radio and ECX uses both radio and television for such purposes.

## IMPACT

There is currently no data in Africa that shows if, and if so, how, ICT used in warehouse receipt systems and commodity exchanges increases any benefits to smallholder farmers or improves the competitiveness of African agriculture commodity value chains.

Further, it is important for donors and practitioners to recognize that ICT is *not* the driver in the development of warehouse receipts systems and commodity exchanges, nor is it even necessary for scale or sustainability. In fact, using ICT (and its challenges) may prove to be an expensive distraction to those working to create successful and useful WRSs and CEXs, given the other critical components that must be addressed for such systems to be successful. Even the Chicago Board of Trade still largely uses a paper receipting process, though the trading floor is electronic. Nonetheless, after the initial cost outlay, ICT software and applications can reduce operating costs. Electronic receipts and automated commodity exchanges can, if properly implemented, increase transaction speed; allow remote participation; and reduce human errors, though the impact may be minimal until trade volumes increase.

## KEY PREREQUISITES

Key prerequisites for both WRSs and CEXs are systems for standardized grading and weights, standardized storage facilities, professional storage management, suitable insurance products, and enforceable standardized contracts and market intelligence.<sup>5</sup> Four other key prerequisites are:

- *A trusted regulator*, who ensures that the systems are transparent and participants comply with their rules. The regulator can be a government body or a private sector body, but must be independent of external influence and completely trusted by the private sector players (particularly the financial sector).
- *Volume*: Estimates vary, but the absolute minimum threshold for cost recovery for a self-sustaining WRS in Africa is estimated at over 120,000 MT. For example, the EAGC Kenyan warehouse receipt program estimates it needs 150,000 MT to cover the cost of regulating the system—this includes staff and regular inspection of the warehouses.
- *Regular Seasonal Price Increases*. For the majority of seasons, the price of the commodity should increase from harvest to later in the season to cover the additional costs of depositing in a regulated warehouse receipt program (handling, storage, and regulation) and receiving financing.
- *Electronic transactions are recognized as legal*. ICT enabled WRSs and CEXs can only be used if electronic documents and transactions are legally enforceable within the country of operation; if not they will have to be backed by physical paper contracts negating much of the improved transaction speeds electronic receipts offer.

In Africa, only Ethiopia, Uganda, and South Africa currently recognize electronic warehouse receipts. In 2004, SAFEX announced it would accept electronic as well as paper warehouse receipts for settlement for future contracts. This was after the Electronic Communications and Transaction Act (ECTA) clarified that agreements concluded by data messages had legal force. The Chicago Board of Trade only started using them for just the rice markets in 2007 and while there is talk about covering other commodities, old preferences remain.

### Purchase 4 Progress (P4P)

The World Food Programme's (WFP) P4P program is working to increase the volumes of staple commodities it procures through local marketing systems, such as a CEX or registered warehouses, rather than soliciting paper tenders as they have historically done. As one of the main commodity procurers in many African countries, WFP can add significant volume to these marketing systems. In Malawi and Zambia, P4P is using the commodity exchange platforms to advertise and handle the delivery of bids against a tonnage and quality specification, rather than placing an offer and receiving individual paper bids. Although passing the volume purchased through the exchanges significantly increases the volumes the exchanges are handling, it does not do so in a manner that builds the market systems in place, but through parallel systems which are unlikely to be adopted for the bulk of the trade undertaken. For example, WFP in Uganda procured 1,796 MT in 2009 through three exchange registered warehouses (approximately 80 percent of the commodity deposited in the warehouses), but not through the exchange itself.

## LESSONS LEARNED

Some of these lessons relate to the development of WRSs and CEXs themselves, some to their use of ICT.

- To succeed, commodity exchanges must be driven by private sector acceptance and financial involvement and, in most cases, evolve to facilitate warehouse receipt systems. Donors and well intended governments should not try to force their evolution onto the market unless the underlying conditions are right.
- The use of ICT rarely, if ever, is a critical success factor to facilitating the establishment of a sustainable WRS or CEX. It can, however, be critical to help the system scale.
- Donors and practitioners can facilitate the development of warehouse receipts in several ways:
  1. Direct more resources to the development of the building blocks required for a successful WRS and CEX system.
  2. Facilitate the establishment of a trusted, capable regulator; providing regulatory training on warehouse operations, regulation, and handling (and not overloading the regulator with the job of integrating smallholder farmers into the systems directly).
  3. Recognize that developing sophisticated systems and changing behavior can take years. Design and fund long-term plans, based on sound business models, with intermediate targets and a realistic exit strategy.
  4. Target the commercial sector (mainly large traders and processors) for incorporation first. They will bring the volumes required for success and may eventually “subsidize” the involvement of small-scale farmers. In 2004, the Zambian Agricultural Commodity Agency (ZACA) began targeting large-

<sup>5</sup> Market intelligence is the need by banks to know enough about the market locally and regionally to be able to assess the value of any warehouse receipt as collateral.

scale commercial farmers, traders, and processors and was showing signs of success. However, increasing pressure to incorporate smallholder farmers and address their development needs meant the ZACA personnel lost their focus and lead ultimately to its insolvency.

5. Depending on the system designed, smallholder farmers will need to work in groups or through associations to meet minimum deposit tonnages.
  6. Focus market linkage efforts on inventory credit, then WRSs and then CEXs.
- For any investments in ICT, facilitate the use of sound ICT practices, which include as an evaluation criterion successfully implemented similar systems elsewhere. Spend plenty of time talking to references (or even visiting them) with specific and open ended questions. For example, ask the references the three things they would have liked to know or do differently if they could go through the process of ICT implementation again; the four ways they would like the system to work better; and the difference between the initial price and time estimates (covering up-front as well as on-going fees) and the actual costs and time taken. If possible, encourage any bidders to include a local firm as a substantive part of their team, perhaps providing some on-going support (backed up system experts most likely elsewhere).
  - Bank support to WRSs and CEXs is more likely if a key banking institution with an aggressive market development program is involved from the start. Intermediary products (such as inventory financing) may facilitate a more successful start up. Providing a first loss guarantee also encourages bank participation.
  - Setting up legislation to specifically cover warehouse receipts and

agricultural commodity exchanges can take years, needs political support, and often needs revising when reality does not match legislative expectations. In most cases the existence of strong contract law is sufficient for WRSs and CEXs to operate.

- Those developing WRSs and CEXs often lack the needed ICT background to clearly identify all software needs and issues. This has resulted in spiraling software development costs and delays in start dates. Specialized ICT consultants should be used to work with implementers to help define functional and technical requirements, design a procurement approach, and consider available software options and an implementation plan that reflects best practices.<sup>6</sup>
- Commodity exchanges only generate “transparent” prices if sufficiently traded volumes of each commodity are passing through the exchange on a regular basis to generate such prices. Price transparency is a side benefit of an exchange—it is not a reason to establish an exchange. One strong role for ICT is to transmit this information—once available—rapidly and efficiently either directly or indirectly through a market information service.
- SAFEX has expanded from a way of finding a remote buyer or seller, including price hedging mechanisms into a vehicle for speculation by hedge funds and others. When it first started, 50 percent of contracts on the exchange resulted in physical deliveries via transfer of a warehouse receipt; now less than 2 percent of contracts result in physical deliveries. The same evolution can be seen on Chicago Board of Trade and LIFFE-EURONEXT. This boom in speculation can be tracked back to the beginning of 2004. Speculative buying in a commodity on an

<sup>6</sup> USAID can help draft terms of reference for selecting such consultants. Contact [jpayne@usaid.gov](mailto:jpayne@usaid.gov) for suggestions.

exchange can result in an exchange price that does not reflect a trading price for the commodity in the market price. Therefore those who use the exchange as a method of price discovery will need to know the premium or discount the real commodity is trading to the price indicated on the exchange. African exchanges could become vehicles for unfettered speculation (and, worse, money laundering) and not service the agricultural markets they were set up to serve.

- ECX’s business model is unique in that the government, through export controls, mandates that coffee buyers and sellers use the exchange. Up until now, very little staple commodities trading in Ethiopia have passed through the ECX system (coffee represents approximately 96 percent of its trading volume). Therefore, while ECX has experienced a rapid increase in volume, and therefore income, the government mandate that drives this success will be difficult to replicate to other commodities (particularly staples) and countries.
- Non-transparent government intervention in markets (buying, selling, price setting, export bans, etc.) as experienced in most of eastern Africa apart from Uganda, disrupts the natural market response, bringing about unpredictable price spikes and dips. This increases the risk of participating in the market, reduces the number of players in the market and ultimately reduces investment in and the usefulness of market institutions such as WRSs and CEXs.
- Any WRS or CEX—with or without ICT tools—needs to have a serious business plan developed up-front to set its path to sustainability. External business consultants may be good resources to assist with this to be “hard nosed” third parties to test assumptions.
- Any use of telecommunications for WRSs or CEXs needs to recognize

limitations or disruptions in access and bandwidth limitations by building into any software ways to confirm data transmissions, off-line work modes and low bandwidth options.

- **Approaches to sustainability/scalability of ICT tools for WRSs and CEXs:** After upfront design, implementation and licensing costs, the costs of on-going maintenance of such tools needs to be recognized in budgets. As a rule of thumb, software maintenance alone (not upgrades) should cost roughly 10 to 20 percent of initial licensing fees. Given these costs, consider starting with relatively simple functionality until volumes increase. This does not necessarily mean that software should be custom developed—usually an expensive approach in the long run. If it is custom developed, try to use a development organization that has experience with such applications and build on software components already working well elsewhere. Also, it is usually better to rely on an ICT business with several employees rather than one or two individuals with little institutional backup.

## CONCLUSIONS

Within emerging markets, WRSs and CEXs have been notably successful in India, where volumes are enormous, rural education levels are higher, infrastructure is available, and speculation (gambling) is part of the culture. WRSs and CEXs have not yet succeeded in Africa beyond South Africa, because the building blocks required for success are still being established.

There is no analysis on the use and impact of ICT on the operations of warehouse receipts and commodity exchanges. There is also very little good analysis on WRSs and CEXs that brings together experiences, lessons learned, models, ICT usage, and comparisons between different operating environments, such as between the Indian models (which are reputed to have successfully integrated large numbers of rural smallholders and benefited immensely from ICT solutions), and those in Africa.

Any successful warehouse receipt system or commodity exchange (national or regional) will need increasingly sophisticated ICT systems, however, ICT is very unlikely to be a critical success factor especially at the outset. It could though, if not implemented based on best practices, be a costly factor slowing any effort's path to sustainability. Also, any donor support using ICT to support such systems should include clearly measurable, intermediate goals (e.g., for periods of six months and using usage metrics, not process metrics) with funding related to ICT contingent on meeting them.

## RESOURCES

- Ethiopia Commodity Exchange: <http://www.ecx.com.et>  
Agricultural Commodity Exchange for Africa: <https://crm.exordia.co.za/ace/index.htm>  
Johannesburg Stock Exchange: <http://www.jse.co.za>  
National Spot Exchange: <http://www.nationalspotexchange.com>  
Sandbox Projects: <http://www.sandboxproj.co.za>  
Uganda Commodity Exchange: <http://www.uce.co.ug>  
ZAMACE: <http://www.zamace.com>
- African Commodity Exchanges Forum has recently started, bringing together African commodity exchanges to share experiences, lessons learnt, and assist each other moving forward. ECX is the inaugural host.
- Coulter, Jonathan. "Warehouse receipting, loss reduction and the development of value chains for grains," (FAO, 2010).
- Sargis, Bernard. "Role of Agricultural Commodity Exchanges in price discovery and risk management for Grains; Implications for East Africa," (World Bank, 2009)
- Walker, Sophie. "Transitioning from providing Business Development Services to facilitating New Business Models: Regulating Warehouse Receipts," (CRS, 2010)
- Financial Technologies Group: software and systems solutions for exchanges. Bourse Africa partner in the Pan African Commodity Exchange. [www.ftindia.com](http://www.ftindia.com)

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