My Oral Village

Oral Financial Numeracy in Tanzania
An Exploratory Study

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and

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Tanzania Indicators	
$1 US: Tz Shilling (March 1-11, 2015 – date of field work)	1,790
Adult literacy rate (World Bank, 2010)	67.8%

Methodology

The field research for this study was conducted from March 1-11, 2015 in four regions of rural Tanzania (Manyara, Kilimanjaro, Arusha and Singida). The survey instrument appears in Appendix 1.

The goal of this study was to test certain hypotheses about the current level of financial numeracy among illiterate individuals, and the impact that skill gaps have on effective financial inclusion. These hypotheses, and the theory behind them, are discussed in a recent paper published by MOVE.[1] The study also sought to conduct preliminary tests of oral information management (OIM) prototypes among individuals who are already using some sort of financial service.

The sample areas were selected based on relatively high levels of illiteracy according to national census data. The main sample was composed of functionally illiterate villagers. These individuals participated in a survey that included a blend of quantitative and qualitative questions. To conduct preliminary OIM prototype tests, most of the sample was reached through financial delivery agents, including Savings and Credit Cooperative Societies (SACCOS) in Arusha and Kilimanjaro, and savings groups in Manyara.

Further qualitative and contextual information was drawn from a series of complementary interviews with primary school teachers and visits to village markets.

Limitations

The sample was not randomized, and results should not be assumed to be statistically representative.

Introduction

Rural Markets

The rural markets visited for this study are well adapted to the needs of the oral economy. In these markets we find that:

- no one uses a calculator;
- no one keeps written records;
- cash is not well stored for tracking -- it is kept in a pouch worn around the waist, or knotted into a *kanga* or *kitenge*, or kept in trouser pocket or plastic bag.

Goods are arranged in small heaps that are aligned with round values in Tanzanian shillings, such as 100 or 500 or 1,000. Most vendors have a half dozen or less stock-keeping units, so transactions involve a very small number of items, and very regular numbers. This means that people can usually manage their transactions in their heads. We were unable to find vendors who were using calculators or keeping written records.

Vendors sell many vegetables, including potatoes, cassava, lime, bitter tomato, onion, cucumber, tomato, green pepper, hot pepper, pineapple, mango, cabbage, yam

[1] See Matthews, Brett Hudson. *Oral information management tools: lighting the path to financial inclusion*. My Oral Village, Inc., Toronto, 2014.

and okra. Blocks of soda and molasses cubes are also sold here, as they complement the preparation of vegetables.

All the vegetables are sold in heaps based on standard pricing in Tsh: usually Tsh 500 or 1,000. The heaps vary by size from season to season, reflecting price changes. For example, if the price of tomatoes rises due to a shortage, the number in a Tsh 1,000 pile drops.

Some items, including salt, rice, oil and a variety of dried legume leaves are sold by the litre or kilogram. Nothing is sold by the gram or even hundreds of grams, but Tanzanians are familiar with halves and quarters, and goods are sold in these fractions of litres and kilos. Containers while not identical are reasonably standardized.

Primary Schools

Five interviews with primary school teachers were conducted, to better understand their views on how financial numeracy is taught in primary schools, on how well it is taught, and on challenges associated with keeping students in school.

In many tribal groups, traditional practices either discourage schooling altogether, or are biased towards sending children to school quite late – for example around age 10. There is a national examination at the end of Standard 4,[2] and large numbers of students drop out then. They have the option of repeating Standard 4, but most are reluctant, either because they consider themselves too old or because they do not want to mix with younger students in a previously-lower class. Their families may also want them to start working.

Even before the end of Standard 4 attendance is uneven. One village teacher reported that about 80 of her 230 registered students attend on a typical day. She estimates that half the villagers are illiterate: the belief in witchcraft is still very strong, and the value of schooling is questioned.

In the field of basic numeracy, a topic that is reasonably well covered in early years is basic calculations. Addition, subtraction and multiplication (including the times tables, 1-12) are taught by various cramming methods, including singing. The evidence of success is visible in the rural markets, where women with little schooling can usually manage a range of simple calculations.

Many of the key gaps in financial numeracy noted in this survey – positional notation, the role of zero, percentages and decimal points – are taught according to the curriculum in Standard 5. Since this is after the national examination, a large number of students never learn these. Division is taught in Standard 4 according to the curriculum. But even here, there are often gaps between the curriculum and what happens in the classroom. The curriculum is taught in Swahili, which was not the mother tongue of most of the students in the sampled field areas (see **TABLE 1** next page for a list of local languages). It is not always clear to the teachers how much Swahili their students are

[2] 'Standards' are equivalent to 'Grades' in America in terms of their order, and expected age of attendance. That is, a person should be the same age in Standard 4 in Tanzania as in Grade 4 in America.

understanding. In addition, many teachers may not be confident in their ability to teach percentages, so they steer clear of the topic. They feel they will lose face if they ask other teachers for help.

Four of the five teachers interviewed believe that the quality of primary schooling has been dropping. The following quotes reflect the general tone of their comments.

> The number of students passing Std 7 increases year by year although the quality drops. I know of people who pass standard 7 without knowing how to read and write. The exam is only multiple choice. People going to secondary school sometimes cannot write their own names.
>
> The quality of schooling is dropping lower and lower due to frequent changes in the curriculum. Teachers are trained in this new curriculum for only 2 or 3 hours, and then they are told to go and implement.
>
> When I studied as a student it was better. It was good when I started as a teacher 7 years ago. Now it is not good.
>
> In the past teaching in Std 1 and Std 2 focused on the 3 'R's. But now changes in the curriculum have broadened it out and pupils don't focus on the core at the start.

Teachers also criticize the quality of the teaching in primary schools.

> The methods [of teaching numeracy] are there and good. The problem is the teachers. Not all the teachers have adequate knowledge to use these methods. Maybe they need seminars. They need reminders and refreshers.

Field Observations

The survey included participants from four regions and eleven mother tongues (see **TABLE 1**). While most groups are settled agriculturalists, many Maasai are nomadic herders who, it was anticipated, might have a distinct financial numeracy profile.

TABLE 1: Sample by Region and Mother Tongue

Home Language	Arusha	Kilimanjaro	Manyara	Singida	Total
Maasai	2	0	8	0	**10**
Chagga	7	0	0	0	**7**
Nyaturu	1	1	0	5	**7**
Gogo	0	0	0	6	**6**
Pare	0	4	0	0	**4**
Iraqw	1	0	0	0	**1**
Hehe	0	0	0	1	**1**
Nyamwezi	0	0	0	1	**1**
Sukuma	0	0	0	1	**1**
Meru	1	0	0	0	**1**
Burunge	1	0	0	0	**1**
Total	**13**	**5**	**8**	**14**	**40**

The sample is summarized by level of schooling and sex in **TABLE 2**. While all respondents were functionally illiterate, levels of schooling varied widely, including one individual

TABLE 2: Sample by Schooling and Sex

Schooling	Female	Male	Total
> 4 years	2	3	**5**
2-4 years	4	3	**7**
< 2 years	5	1	**6**
None	21	1	**22**
Total	**32**	**8**	**40**

who had completed Standard 7. More than half the sample had received effectively no formal schooling at all.

TABLE 3 summarizes the sample by livelihood or occupation. Most of the sample are farmers, however a variety of other activities are represented, including two individuals (a waiter and receptionist) who are engaged in informal employment.

TABLE 3: Primary Occupation by Sex

Primary Occupation	Female	Male	Total
Farmer	24	7	**31**
Weaver	3	0	**3**
Stone breaker	1	0	**1**
Brewer	1	0	**1**
Firewood trader	1	0	**1**
Shop owner	1	0	**1**
Receptionist	1	0	**1**
Waiter	0	1	**1**
Total	**32**	**8**	**40**

Counting and Positional Notation

The respondents were asked to count 107,500 Tanzanian shillings (60 $US) in cash – see **TABLE 4**. In most cases, the cash was provided in 16 notes: nine 10,000s, three 5,000s, a 1,000 and three 500s. All of these notes are in regular use in the village economies. Adding the notes together is also a test of addition.

TABLE 4: Capacity to Decode a 6-Digit Numeral String, by Sex and Schooling

	N	States correct amount?	Selects correct numeral string?
Sex			
Female	32	27	3
Male	8	6	0
Schooling			
> 4 years	5	4	1
2-4 years	7	7	1
< 2 years	6	5	0
None	22	17	1
Total	**40**	**33**	**3**
%	100%	83%	8%

Most of the respondents were able to count cash and announce the result correctly. Their fluency with this task varied widely. Some counted quickly and then confidently announced the result. Others struggled: laying the cash in piles on the table in front of them, counting each individual pile one or more times, and trying, sometimes without success, to add the piles together to reach a total. A few tentatively reported interim results to the researcher, perhaps seeking clues. The researcher did not help, but could probe by asking 'are you sure?'

Performance in counting cash does not appear to have meaningfully varied by sex, but may improve slightly by level of schooling.

Once respondents announced the total, the researcher showed them a list of written numbers (see image at right), and asked them to select the correct one. The choices test the respondents' knowledge of positional notation by re-arranging zeros and changing orders of magnitude. Eight correct answers can be expected by chance, assuming everyone guesses with neither knowledge nor prejudice.

As shown in **TABLE 5**, only three responded correctly. Nearly half declined to answer, including most of the women. They described the question as 'very difficult', waved it away in mock horror, or even (in one case) apologized for their inability. Most of the 20 who attempted the question studied it closely before responding.

TABLE 5: Capacity to Decode a 6-Digit Numeral String, by Sex and Schooling (cont'd)

		Response					
Sex	**N**	**"None"**	**"17,500"**	**"207,500"**	**"107,500"**	**"1,075,000"**	**"175,000"**
Female	32	19	1	0	3	4	5
Male	7	0	4	0	0	2	1
Schooling							
> 4 years	5	2	1	0	1	0	1
2-4 years	7	2	0	0	1	3	1
< 2 years	6	2	1	0	0	3	0
None	21	13	3	0	1	0	4
Total	**39**	**19**	**5**	**0**	**3**	**6**	**6**
%		49%	13%	0%	8%	15%	15%

As a large majority can recognize numerals, none chose '207,500'. The correct answer was the next least likely to be chosen – and when it was chosen, it was chosen with little confidence. It is not entirely clear why this was or whether it would be replicable in a larger test.

One bright middle-aged mother who counted very quickly examined the writing closely and stated "175,000". She spoke for several others when she remarked:

> "I can identify 3 numbers here: 1, 7 and 5. The numbers are all together, so it seems to be right."

A man who had attained Standard 7 selected 17,500, remarking confidently:

> I see the 1, the 7 and the 500. The others have lots of numbers but this one has the right number of numbers.

Oral encoding in Swahili, as well as in the other salient languages in this study, does not emphasize the location of the zeros. Oral encoding may focus attention on positive integers, leading to an assumption that they belong together.

Calculations

Facility with **subtraction** appears in **TABLE 6**. Participants were asked how much change they should get if they purchase an item costing Tsh 7,800 and provide the shop-keeper with a Tsh 10,000 note.

A small majority were able to answer this question. Some performed the calculation quickly in their heads, but most used their fingers and some took a long time. While years of schooling are clearly a factor in predicting accuracy, levels of experience in the marketplace also appear relevant, especially among those with little schooling.

TABLE 6: Capacity to Calculate Change, by Schooling

	N	Subtraction (making change) correct?
Sex		
Female	32	20
Male	8	5
Schooling		
> 4 years	5	4
2-4 years	7	7
< 2 years	6	4
None	22	10
Total	**40**	**25**
%		63%

A typical successful respondent described her system this way.

> I counted 7 fingers completely for the cost, then split the 8th finger with 200 going to change, and 800 to cost. Then I added the 9th and 10th fingers to complete my change.

The many erroneous responses ranged from "3,000" to "1,500".

Facility with **multiplication** appears in **TABLE 7**, along with skill in estimating volume. The volume presented was a picture of a 10 kilogram container, with 2.5 kilograms of maize flour at the bottom (see image at right).

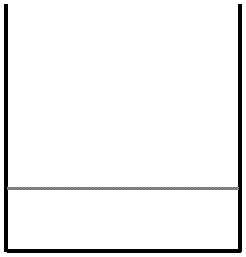


TABLE 7: Estimation of Volume and Price, by Sex

Sex	N	Quantity estimate correct?	Multiplication correct?
Female	31	21	28
Male	8	5	8
Total	**39**	**26**	**36**
%		67%	92%

Both '2' and '3' kilograms were deemed correct. (Only one respondent ventured '2.5'.) Most over-estimated the volume presented; the average response was 3.3 kilos. Several Maasai estimated 4 or 5, skewing up the average. Nomadic populations have been observed to be less accurate in volume estimates than farming populations.[3]

Almost everyone in the sample – 36 respondents out of 39 – accurately calculated the cost of the maize flour based on a quoted price of Tsh 1,500 per kilo. This calculation involves multiplying kilos by price per kilo.

Facility with **division** appears in **TABLE 8**, and was generally much weaker than capacity to multiply. Participants were asked how much they would need to save each year in

TABLE 8: Capacity to Divide, by Sex and Schooling

	N	Tsh 1 m in 5 years? year?	month?
Sex			
Female	32	8	1
Male	8	5	1
Schooling			
> 4 years	5	2	0
2-4 years	7	5	2
< 2 years	6	1	0
None	22	5	0
Total	**40**	**13**	**2**
%		33%	5%

[3] They have also been observed to be more accurate at area estimates, which were not conducted in this study. See Poortinga, Ype H. & Fons J.R. Van de Vijver. *Culture and cognition: performance differences and invariant structures.* In Sternberg and Grigorenko, eds. Culture and Competence: Contexts of Life Success. American Psychological Association, Washington, DC. 2004; p. 141.

order to save Tsh 1 million in 5 years? If they succeeded they were then asked how much they would need to save each month to achieve the same goal?

A bright, unschooled woman worked out the annual figure without using her fingers. She explained

> If I save 100,000 a year for 5 years I would have 500,000. But I need a million so I will do this twice!

Instead of dividing, most successful respondents multiplied different numbers by 5 until they got one that matched 1 million. This is a laborious process with pitfalls. One woman who did it struggled with the elementary properties of arithmetic.

> Maybe 200,000 … but I have doubts! I know that one million is 200,000 X 5. I'm not sure if this [fact] is the secret -- but I know that much!

In other words, "I know that one million is 200,000 X 5. Does this mean that one million divided by 5 is 200,000? That I don't know!"

Those who did not succeed often remarked on how difficult this was, and tried to count on their fingers, without success. Some took a long time

> This is very hard!
>
> [2-3 minutes of struggle and perplexed looks later]
>
> "500,000"? [Another pause …] "Am I allowed to use my fingers?"
>
> Counts her fingers then finally says she gives up.

Only two of those who did succeed came close to a correct ***monthly*** figure, estimating "20,000".

While level of schooling appears to have had a modest ability to predict the result, there were other factors, with the most important appearing to be natural intelligence and experience in the markets.

Since **percentage** is the foundation of pricing in financial services, respondents were asked to state how much interest they would owe after one month if they borrowed Tsh 400,000 at 5% a month? A follow-up question – "what is 100% of 400,000?" – was included to test the respondent's grasp of the conceptual foundation of formal pricing.

Only two respondents were able to correctly answer ***either*** of these percentage questions, and one of these appears to have answered correctly by accident.

> "*Asilimia* [percentage] is a difficult Swahili word that I cannot understand. Nowadays Swahili has very difficult words to understand."

Savings groups and SACCOS, aware of this conceptual gap, do not quote their rates in percentages. Instead they quote by volume borrowed, for example:

"The interest rate on your loan will be 6,000 for each 100,000."

These volume quotations neatly side-step the conceptual gap related to percent, but have their own problems. They do not always clearly specify the amount of time-value that the borrower is buying. (When the staff at one SACCOS were asked about this, their answers ranged from 4-6 months, and a debate quickly broke out which had not been resolved when we left.)

Volume quotations are also more complex than percent quotations. For example, what would be the cost of borrowing 126,000 Tsh? A SACCOS or savings group leader *should* be able to calculate this by applying the percent principle. But the evidence showed that these literate individuals had, at best, a very fragile grasp on the percent concept themselves. Price quotes for irregular sums may prove, in practice, highly variable.

Calendars

Calendar time is one of the pillars of the modern concept of time-value of money. The shift from traditional conceptions of in-kind value to modern conceptions of financial value depends on the acquisition of habits and skills related to calendar time. In every society, this process has proven gradual. Awareness and use of calendars in this sample is summarized in **TABLE 9**.

TABLE 9: Awareness and Use of Calendars, by Sex and Schooling

	N	Weighted Use	Calendar in house?	Use calendar?	Plan with calendar?
Sex					
Female	32	19%	6	8	4
Male	8	42%	3	4	3
Schooling					
> 4 years	5	47%	2	3	2
2-4 years	7	52%	2	5	4
< 2 years	6	17%	1	2	0
None	22	11%	4	2	1
Total	**40**	**23%**	**9**	**12**	**7**
%			23%	30%	18%

Less than a quarter of the sample have a calendar in their homes. Even those that do rarely mark them in any way, reporting that they keep future dates in their memories. When asked how they use a calendar, a number of people expressed confusion about the question.

I don't know what to do with it other than look at the date.

This confusion may be explained by the fact that respondents expressed strong confidence in their memory for the dates for future meetings and other activities. And oral cultures may not envision the same role for calendars as literature cultures do.

> I mark important events in my head without a mark. I remember I witnessed a man knocked by a motorbike Jan 5th and he died. So I remember the date.

A calendar is a literate tool filled with rows, columns and cells that may baffle oral subjects. A few respondents commented that if they needed to use one they would ask their children to interpret it for them. A Burunge-speaking farmer and SACCOS member commented:

> My children have calendars on their phones. I ask them to look for dates if I need them.

One respondent reports using the calendar to mark religious festivals.

> I may mark a date in the future. Christians fast for 40 days before Easter. The first day is Kwaresima and then I count 40 days to the 'Great Friday' [Easter].

A 37-year old Chagga businesswoman who attained Standard 4 uses a calendar to track her loans and monitor her livestock.

> If I take a loan, I mark the date that the loan is issued, and the dates for loan repayment. I am a livestock keeper. I watch when my cow enters heat so I knows exactly when to inseminate it.

Although calendar use is limited at every level of schooling, years of schooling may have more impact on it than on counting or calculating skills. The syntax of rows and columns embedded in a calendar is taught in Tanzanian primary schools in upper classes.

The practice of using calendars to plan time emerged with modern literate culture, and helps individuals to plan their time independently from one another. But oral cultures habitually and routinely engage in collective time-keeping and remembering

TABLE 10: Ownership of, or Access to, a Mobile Phone, by Sex and Schooling

		Mobile Phone?		
	N	**Individual**	**Access (family)**	**No**
Sex				
Female	32	19	9	4
Male	8	6	1	1
Total	40	25	10	5
Schooling	0	0	0	0
> 4 years	5	3	1	1
2-4 years	7	6	1	0
< 2 years	6	5	1	0
None	22	11	7	4
Total	**40**	**25**	**10**	**5**
%		63%	25%	13%

practices: planting and harvesting, animal raising, migration and life cycle events, among others. The purpose of a calendar may seem opaque in this setting.

Mobile Inclusion

Nearly two-thirds of the sample have a phone of their own (see **TABLE 10**), which they do not need to share with other family members, and only five respondents have no access to a phone. The most excluded segment is the unschooled population: only half have a phone of their own. This distribution seems predictable: illiterate individuals in this sample – both women and men – usually let their spouses keep the phone, since the better educated spouse is deemed better able to use it.

The average respondent cited 1.8 capabilities related to using her mobile phone (see **TABLE 11**). Most respondents claim to be able to answer a call, but less than half claim to be able to place one, and even fewer know how to use the phone's address book. Only two know how to create address book entries and/or use the calculator and calendar functions on their phones.

TABLE 11: Use of Mobile Phone Functions, by Sex and Schooling

	N	Weighted response	Receive call	Place call	Create address book	Use address book	Use calculator	Use calendar	Mobile money account
Sex									
Female	32	1.4	21	9	0	7	0	0	7
Male	8	3.3	6	5	2	5	2	2	4
Schooling									
> 4 years	5	3.2	4	3	1	3	1	1	3
2-4 years	7	3.1	6	6	0	6	0	0	4
< 2 years	6	1.7	5	2	0	2	0	0	1
None	22	1.0	12	3	1	1	1	1	3
Total	**40**	**1.8**	**27**	**14**	**2**	**12**	**2**	**2**	**11**
%			68%	35%	5%	31%	5%	5%	28%

The two who can create address book entries both use a Nokia Torch, a $20 mobile phone with a built-in flashlight and a menu of simple images that can be attached to address book entries. This enables them to create entries without negotiating text; an empowering feature for oral populations.

In Tanzania mobile money is very well developed, and eleven respondents had mobile money accounts on their phones. Two of these are neo-literates who use mobile money independently. The other nine use adaptive strategies that involve varying degrees of dependency, and associated risks.

Mobile money transactions in Tanzanian villages are mostly funds transfers, for example from a parent to a child in school, or from a working child to a parent in the home village. They can be split into three functions:

- a 'cash-in' transaction in which a sender increases the balance in her mobile wallet by giving money to a registered mobile money agent such a shop-keeper;
- a digital transfer initiated by the sender using the mobile money interface on her phone; and
- a 'cash-out' transaction in which a recipient receives notice on her phone that the sender has transferred the funds into her own mobile wallet, and visits an agent in her village to withdraw the cash.

Cash-In Transactions

As oral villagers, the respondents in this study were more likely to receive money than to send it, but four described cash-in transactions. These were of two types. The first, 'over-the-counter' (OTC) involves an agent using his or her own phone and mobile account to transfer on behalf of a client. A neo-literate receptionist in a small hotel who had never been to school, but had taken some adult evening classes explained:

> I send money but not through my phone. Instead I give the money to the agent and the agent sends through his phone. I don't know if I can use the agent to put money on my phone and then send it. Agents get a commission on every amount they send, so they like to send the money themselves!

The second method is riskier. Referred to by three respondents, it involves giving their phone and PIN number to the agent.

> Yes, I use m-Pesa to send money to my grand-children in Dar. I take the money and my phone to the agent and tell him I want to send this money to this person. He finds the person in my phone address book, takes my PIN number, and sends the money. I call my grandchild to tell her about the money: when it is coming, and how much to expect.

Transfers

Mobile account holders were asked to transfer a small payment from a research account to their own account using a mobile phone. Only the two neo-literates are capable of independently performing this transfer.

One of them admitted that he has sent the wrong amount in the past – less by an order of magnitude – due to weak knowledge of positional notation. Multiple transfers trigger multiple fees, which he does not like.

Cash-Out Transactions

Five account holders reported visiting the agent themselves to receive cash, and in each case stated the same procedure.

> I use m-Pesa. My kids send me money through it. When they send they call me and tell me to go to the shop and take it. I give the phone and my password to the agent and he gives me the money.

> I send money to my sons. I go to the agent, give my phone and password to the agent, and he transfers the money. When I get money I do the same. I get the message and go to the agent who takes my password and gives me the money. The agent has a register for all customers. I don't get a paper receipt. The agent writes everyone's name, phone, and amount you get in his registry. I get an electronic receipt from the network.

Delegation to relatives
Two mobile account holders never use their accounts independently. When they receive money or wish to send it, they give their phone to a family member.

> I don't know the PIN for my m-Pesa account because my son registered the SIM card and handles all m-Pesa transactions for me.

In spite of their dependency when it comes to mobile money, oral mobile wallet owners have considerably greater financial numeracy skills than most other study respondents (see **TABLE 12**).

Oral mobile money users are far more adept with phone use than non-users. In addition, only three out of 22 unschooled respondents are mobile account holders (and as noted above, one of these can be classified as 'neo-literate'). The three respondents who correctly identified "107,500" in writing are all mobile account-holders. Account-holders are also much more likely than non-account holders to use a calendar for one or more purposes.

TABLE 12: Selected Financial Numeracy Indicators, Oral Mobile Money Users

	Mobile Account?		Total
	Yes	No	
Total = N	11	29	**40**
Female	7	25	**32**
Years of school			
Average	3.0	0.9	**1.5**
Number with no schooling	3	19	**22**
Mobile phone skill indicator	4.2	0.8	**1.8**
Counting money			
Count and state correct amount	10	23	**33**
Identify written numeral string	3	0	**3**
Time			
Have calendar in home?	5	8	**9**
Use it for one or more purposes	4	4	**12**

Oral Information Management (OIM) Tools

A basic OIM prototype tool was tested in two communities where there are SACCOS, in Arusha and Kilimajaro. To test OIM, the research team adapted the existing SACCOS' products by integrating OIM principles, and then assessed the understanding of the members.

The product offerings of these SACCOS were broadly similar, with one important distinction (see **TABLE 13**).

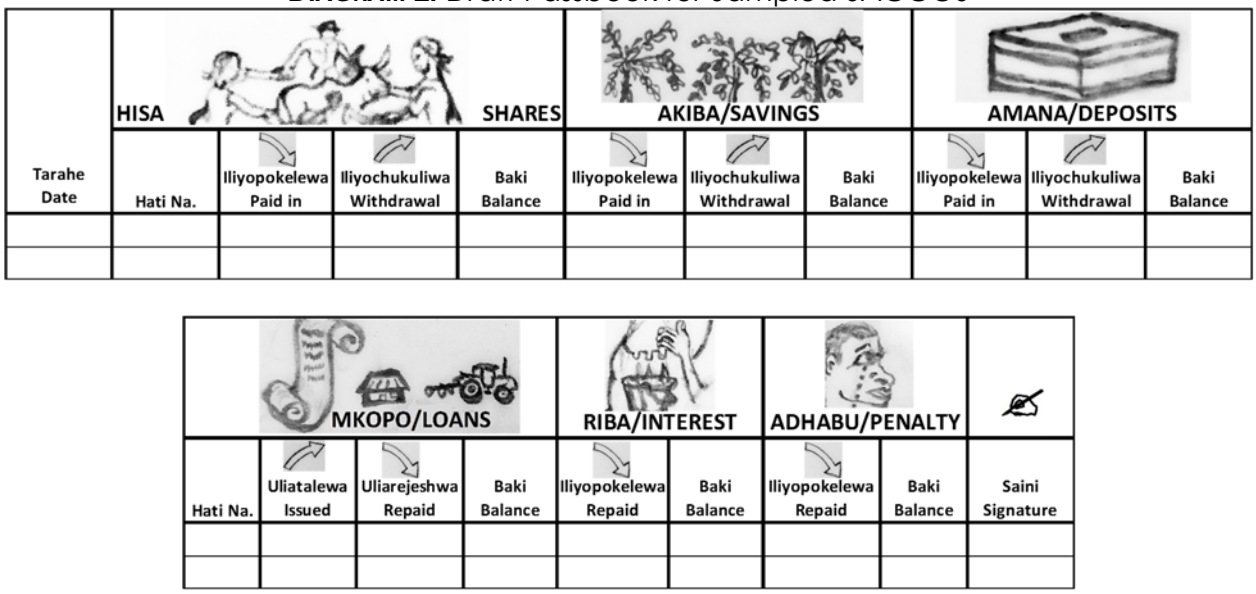
TABLE 13: SACCOS' Product Offerings

Product	Description
'akiba'	loan collateral product that levers 3X deposit in loans
'amana'	Voluntary savings, no interest
Loans	6% for 4-6 months (Monduli) 3% a month (Chekimaji)
Shares	Only withdrawable on exit from the SACCOS

Very few SACCOS offer dividends or interest on savings, although technically these distributions are part of their policies. There is no space on the individual passbook or the individual ledger to record interest on savings, and those SACCOS that offer it usually awkwardly record it in the wrong columns. The passbooks, deposit slips, individual ledgers and other retail documents are standardized across both SACCOS sites. The passbook has 20 columns laid out in the format and order in **DIAGRAM 1** (next page), without the images and arrows, which were added for this study.

The images here were generated in a 2-hour focus group with illiterate members of a farmers SACCOS in the Arusha community. For example the members associate saving

DIAGRAM 1: Draft Passbook for Sampled SACCOS



with growing coffee, and the image of 3 coffee trees evokes the 3X leverage on loans the members associate with these deposits. Most loans are for housing or tractors, and for this group, the word 'penalty' evokes a crying man.

During interviews we showed participants an empty page from a passbook and prepared them by explaining the images once (which took about 3-4 minutes). We then wrote the date in the upper-left cell, and asked them where an entry would go if they came to the SACCOS and deposited 1,000 Tsh in their *amana* account (see **TABLE 14**)? To ensure that the result was robust, we then varied the transactions randomly, asking about a loan repayment one time, a penalty the next, etc.

TABLE 14: Ability to Find a Cell in an OIM Record, and Write in the Cell, After Explanation

Schooling	Passbook		
	N	Find entry point	Write in it
2-4 years	8	7	5
< 2 years	6	4	2
None	20	13	7
Total	**34**	**24**	**14**
%		71%	41%

For the most part, this task was performed slowly, with fingers hesitating, lingering and moving abruptly on. The task may appear simple to a literate eye, but it is not. The passbook has 20 columns and 11 rows (not all shown here) for a total of 220 cells. For an unschooled person, there are few clues to determine which of these 220 cells is correct. Nevertheless, 24 succeeded on the first or second try, and were able to repeat with other transactions. This suggests that the images play an effective role in supporting navigation by oral users within a tabular system.

We offered this successful group of 24 a pen, and asked them if they could write the entry in the correct cell? Fourteen took up the pen and made a recognizable effort to write the number. Writing was often slow and not clear. The biggest problem people had was working out how many zeros to include in a number. (For example, does ten thousand have 3 zeros, or 4?)

The Adult Number Line

The 'adult number line' is an analytical tool that can help clarify the financial numeracy profile in a given context, by mapping the numerical foundations on which local numeracies are built.

Stanislas Deheane, in his book The Number Sense,[4] describes the considerable research that has been done – to date mostly in developed countries -- on the adult number line. Humans have an innate understanding, whether schooled or not, of the numbers 1, 2 and 3. Even among educated adults in advanced societies, these numbers are used far more often than larger numbers, such as 7 or 8. There are peaks at 10, 100, 1,000 etc, which are used far more often than the numbers adjoining them. The whole number line gradually descends in frequency of daily usage as the numbers grow. One trillion for example, is used less often than 1 billion, which is used less often than 1 million, etc.

Numbers are an important part of daily life, and are particularly important to modern monetized life. At the height of their civilization, the classical Athenians rarely used numbers larger than hundreds.[5] Yet, as paper money seeps – or floods – into a village economy, the salience of numeracy increases exponentially. This is particularly true in the many countries – like Tanzania -- where notes denominated in thousands and tens of thousands of units are needed to buy basic household necessities like oil, soap or salt.

4 Dehaene, Stanislas (2011). The Number Sense [How the Mind Creates Mathematics]. Oxford University Press, New York.
5 Schmandt-Besserat, Denise (1999). The History of Counting. William Morrow & Company, New York; p. 27.

A sub-set of this sample was asked the largest number that they had heard or talked about in the last week, and the largest number that they had heard or talked about in their lives. When asked the first question most respondents mentioned very small numbers.

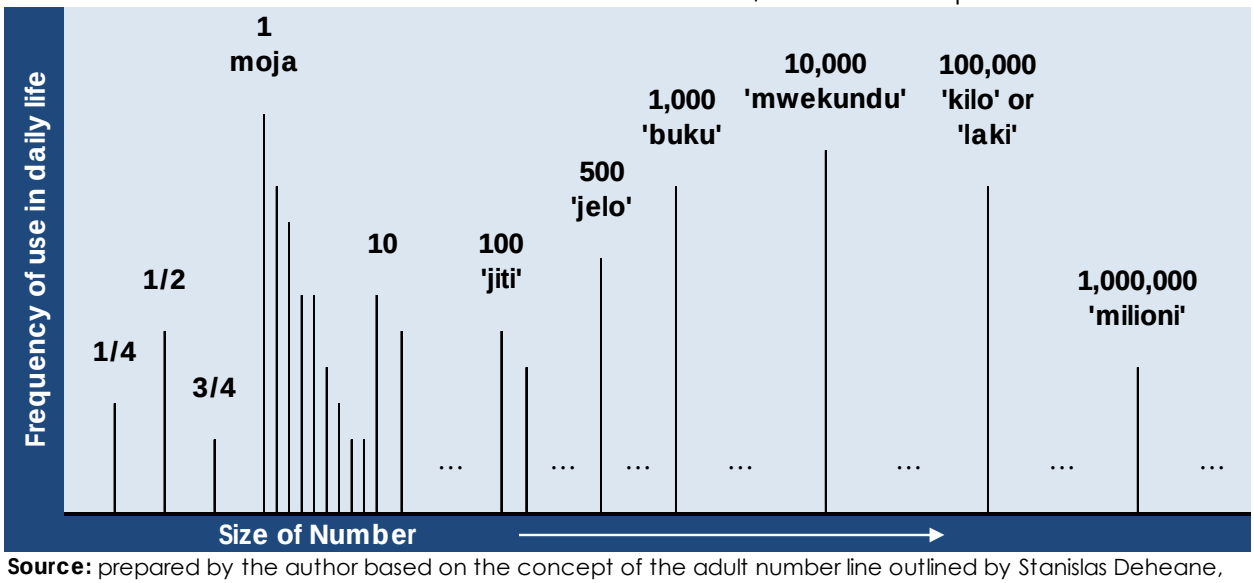
> Six. I used it to count my chickens. There are eleven alive but six had died.
>
> The number of people living in my house: I have three kids, my father and myself; so five of us altogether.
>
> I don't remember using any numbers last week.
>
> I hear lots of numbers. I don't know which are the biggest. I get 4 or 5 maize sacks from my farm.

When asked the largest number they had ever heard or discussed in their lives, the responses were much larger. However, cash sums are by far the most common context in which these larger numbers are referenced.

> 10,000. I used to buy kilos of maize and I would get 3,000 in change back"
>
> Millions! That will always be amounts of money. The biggest other numbers are the number of cattle: maybe 50 or 100.
>
> The biggest number I hear is maybe six, seven. But there are bigger numbers, always about money – for example 5,000 or 6,000 shillings.
>
> My husband died a few months ago, but he used to work in a mission. I had to count the money. I have counted up to two hundred thousand shillings.

Based on the observations from this study, the 'adult number line' in **DIAGRAM 2** may be typical of oral Swahili speakers in Tanzania.

DIAGRAM 2: Illustrative Adult Number Line, Oral Swahili Speakers



Source: prepared by the author based on the concept of the adult number line outlined by Stanislas Deheane, The Number Sense.

Several points should be noted about this diagram:

- among larger numbers, the frequency peak is at 10,000, since this currency note, and transactions involving it, are extremely common;
- numbers above a million are very rarely used;
- 'zero' is not clearly conceived of as a number, and consequently doesn't appear;
- negative numbers are entirely absent;
- percentages are absent;
- decimals are not used at all;
- the fractions used are simple: most oral respondents could not deal with complex fractions like 1/8th or even 1/3rd.

This number line is characterised by a sharp bifurcation between traditional and modern numbers. Day-to-day awareness of numbers greater than one thousand exists almost entirely in the domain of cash. The numeracy skills required to process such numbers may appear only in this context, too.

Conclusions

The delivery of information is vital to achieving real financial inclusion. One strategic information gap involves financial numeracy – the capacity to decode routine numerical information and subject it to simple manipulations. These skills support sound cash- and account-based decision making, and increase confidence in cash as a reliable store of value. Financial numeracy is not adequately measured or tracked at present, but the availability of a good indicator could be extremely useful.

Most of the individuals we surveyed could accurately count a complex, 6-digit sum of cash (with multiple zeros scattered around it), and correctly state the count in Swahili. But a large majority could not identify the number when it was presented to them in Arabic numerals as part of a list with 4 other similar numbers. They often erred by an order of magnitude, choosing 5 or 7 digit strings instead of a 6-digit one, in spite of the fact that the Swahili word *laki*, which they had spoken, refers only to 6-digit numbers.

This observation has far-reaching implications for the usability of financial services across delivery channels. Oral household managers are naturally reluctant to deposit savings, make loan repayments or initiate mobile payments without a real-time receipt that they can decode.

Although we did not offer to share the OIM forms with either SACCOS where we conducted sampling, managers of both SACCOS requested them after speaking to our respondents, stating that they wanted to integrate them into their retail operations. Group-based channels like solidarity circles and savings groups could facilitate mutual learning between more advanced and less advanced learners. Microfinance institutions also rely on personal passbooks or similar transaction records that could be usefully oralized.

Mobile money – as a product of the information revolution -- is also a natural channel. It may be a decade or two before the average illiterate villager has a smart phone -- potentially enabled with voice recognition, text-to-speech and biometric identification capabilities, as well as numeracy games and similar specialized apps. Once that happens, technology will no longer be a limiting factor in efforts to achieve financial inclusion. It is important that when that moment arrives, the solutions to the demand-side capability and behavior issues have been designed and proven, and are ready for migration to more robust platforms.

The impact of schooling on financial numeracy skills among the functionally illiterate sample in this study was quite limited. Their participation in markets and their daily experience handling money appears to have had at least as much impact on their competencies. In spite of this, schooling clearly helps, and could help more. In particular, positional- and tabular-notation could be learned in earlier grades.

The open-mindedness of illiterate people when confronted by requests that they decode financial tables -- or even write, perhaps for the first time since childhood – has been striking. If adults are willing to learn as part of the process of entering the cash economy and the financial sector, there are clear benefits to offering them the opportunity.

It is often assumed that financial numeracy is principally about teaching people simple arithmetic calculations. This study questions that assumption. Most respondents could add, subtract and even multiply surprisingly large numbers, though they did face particular problems with division.

The true challenge of financial numeracy is more basic: people can count orally but cannot translate their oral coding to text. Foundational arithmetic concepts are also missing, including

- the position of '0' in a written numeral string
- the number of zeros in larger numeral string (3+ numerals)
- the concept of percentage: that 100% of a number *is* the number,
- the concept that division is simply the inverse of multiplication

How is it that people can count money and correctly state a large amount in words, yet are unable to recognize the written equivalent? Sadoski and Paivio elaborated a *dual coding theory* of reading and writing[6] that appears to fit these observations well. There are two coding systems for counting large numbers, one in oral Swahili and the other in Arabic numerals. While there are obvious parallels between these two systems, including a one-to-one correspondence between the numbers in each, these two systems are independent of one another in a way that is analogous to the way that written text is independent of spoken language. The two systems of encoding have different historical roots, different protocols, and different rules and practices of use.

[6] Sadoski, Mark and Allan Paivio (2001). Imagery and Text: A Dual Coding Theory of Reading and Writing. Lawrence Erlbaum Associates, Mahwah, NJ.

The oral adult number line illustrates the distinctions resulting from dual coding quite clearly. Zero is missing, as it is not directly referenced in multi-digit numeral strings in Swahili. (This situation is similar to that in English. For example, one does not use the word 'zero' when referencing a thousand of something, although there are three 'zeros' in the written numeral string.)

An example related to the rules and practices related to zero appears in **TABLE 15**.

TABLE 15: Dual Coding Example, Written and Spoken Swahili.

Digit string	Standard Swahili	Normal Oral Swahili	English transliteration
10,001	Kumi elfu na moja	Elfu kumi na moja	Ten thousand and one
11,000	Elfu kumi na moja	Elfu kumi na moja	Ten-and-one thousand

In oral Swahili 'zero' is rarely used or mentioned. In three-digit numeral strings where zero functions as a placeholder it appears in oral Swahili as an 'and' ('na'), just as it does in English. But (like English) this pattern breaks down with larger numbers. There is an 'and' in the phrase 'ten thousand and one' – but how would the speaker who is not familiar with the written equivalent know that it refers to *three* zeros?

The coding challenges resulting from different rules for written and oral numbers are compounded by evolving practices, as can be seen in the difference between 'standard' or rules-based Swahili and the 'normal' Swahili found in village markets.

Conceptually, both decimals and percentages derive from positional notation protocols, and are quite difficult to either visualize or understand in the absence of this foundational concept. Decimals proved unimportant in the oral economy of Tanzania, although they can play a role in oral economies, such as Timor Leste, where the US $ is the national currency.

The profound lack of awareness of percentages (which was replicated in both companion studies[7]) raises a thorny issue of transparency among oral financial services users. Percentages are central to the pricing of financial services. This study bears out the insight from financial diaries that interest is viewed by informal users more as a *fee* than as a time-sensitive *rate*.[8] Less than a quarter of the sampled individuals in this study had a calendar in their home, and even less knew what to use it for.

The OIM approach is intended to lower demand-side transaction costs to a market-clearing level by making information transparent where possible, and by building critical skills where practical. Poverty in oral communities is hypothesized to be importantly about being stranded 'in the present'. This results from insufficient numeracy to manipulate large numbers in a cash economy, and to process the calendar and clock time-values that underpin a modern financial system.[9] In this situation savings will migrate very reluctantly from in-kind to cash forms.

[7] in Timor Leste and Cambodia.
[8] See especially the discussion in Collins, Daryl, Jonathan Morduch, Stuart Rutherford and Orlanda Ruthven. Portfolios of the Poor: How the World's Poor Live on $2 a Day. Princeton University Press, Princeton and Oxford, 2009, pp. 134 ff.
[9] See Matthews (2014), pp. 14 ff. for a discussion of Ong's argument that oral individuals are trapped in the present.

The OIM approach counsels the tactical integration of image-based calendars into the retail interface, along with a focus on clear calendar-based time-signals in the context of savings products (such as emphasis on tangible personal savings goals).

Although cash is a product of literate culture, and embeds Arabic numerals, it also carries images and mnemonic devices that provide support to oral populations. Oral users are not confident in their decoding of multi-digit numeral strings, such as those in the corners of Tanzanian notes. They rely either partly or exclusively on other cues, such as the colour of the note, an image on it, or its relative size (or a combination of these).

The ability of the oral population to count to 107,500 using cash, even if they cannot recognize the Arabic numbers embedded on the notes, suggests that cash functions to partially bridge the oral and literate coding systems. This should not be surprising. It is one of the only literate technologies in widespread use among oral populations. And its use, unlike the use of any other literate technology, is virtually ubiquitous. Mobile phones are still far less widely diffused than cash. It is a distinct possibility that the pace and depth of mobile phone adoption in oral communities is affected by the breadth and depth of the pre-existing cash economy.

Recommendations

For Financial Service Providers

1. Financial service providers (including banks, microfinance institutions, mobile money providers, savings group facilitating agencies, etc.) delivering services to oral populations should assess four critical financial numeracy skills among users and potential users of their services:
   - numeral recognition;
   - positional notation, including the role of zero;
   - syntax of rows and columns; and
   - the 'percent' concept.

2. Financial service providers should integrate oral information management (OIM) solutions into their retail interfaces to achieve two goals with respect to the four critical financial numeracy skills:
   - ensure that customers understand the information that is vital to transactional integrity for them; and
   - build customer capacity in targeted skills through repetitive transacting.

3. Cash denominations (and related imagery) are a universal language that can be used more effectively and creatively by all FSPs to support oral financial services users' efforts to count and process large numbers.

For Stakeholders in Financial Inclusion

4. Further research on solutions to key gaps in financial numeracy is needed. An area of particular importance and urgency is to determine ways to build working awareness of time-value of money through simple OIM solutions and repetitive transacting at the retail interface.

5. The ability to decode a written multi-digit numeral string may be a useful summary indicator of financial numeracy. This hypothesis might usefully be subjected to a more rigorous and larger test. If the measure proves robust consider mainstream it into financial inclusion surveys.

Appendix: Survey Instrument

Name:

Village:

Age:

Home language:

Occupation:

Years of school:

1. Do you participate in any of the following financial organizations:

   □ bank
   □ microfinance institution
   □ SACCOS
   □ VICOBA/Hisa
   □ *upatu*/ROSCA
   □ *kuzikana*/funeral society

2. Do you have a mobile phone?

   □ Yes, I own a mobile phone of my own
   □ Yes, I have access to a mobile phone in my family, and I use it
   □ No

3. If yes, which of the following activities do you use it for?

   □ answer a call
   □ call someone else
   □ create address book
   □ use address book
   □ add, subtract, multiply or divide
   □ schedule meetings or activities
   □ transfer or save money

4. Please count this money? [Hand the user Tsh 107,500.]

Oral response correct? □ Yes □ No

Note how it was counted:
- verbally (quietly or out loud)
- other method

5. Show the following numbers on a sheet of paper, and ask her to select the correct one.

17,500
207,500
107,500

1,075,000
175,000

6. Tell her to imagine that she is in the market on Saturday morning, and that she wishes to buy a bag of maize flour from your shop that costs Tsh 7,800. Ask her how much change she should receive from a Tsh 10,000?

Is the response correct? □ Yes □ No

7. Give piece of paper and pen. Please write the number of your children? (Alternatively, your day-of-week of birth)

8. Give the interviewee a passbook and Tsh 1,000. "Here is a passbook like those used in Savings Groups. Here is Tsh 1,000. Please imagine you are depositing this in your Savings Group, and there needs to be an accurate record in your passbook.

   Where would you write the entry for the deposit?

   Can you please write the deposit amount in thousands?"

Can the respondent find the location to write the entry? □ Yes □ No

Is the deposit amount written correctly? □ Yes □ No

9. "Please imagine you borrowed Tsh 400,000 two months ago and after a month you need to pay the interest, which is 5%. How much money were you charged in interest?

   Is the response correct? □ Yes □ No

   If 'no' ask if the interviewee can identify 100% of Tsh 400,000?

   Is the response correct? □ Yes □ No

10. Do you have a calendar in your home?

□ Yes □ No

11. Do you know how to use a calendar? If so, what have you used one for?

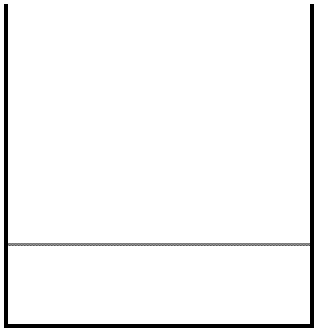
12. You have set a goal of saving Tsh 1,000,000 in 5 years. How much do you have to save each year to reach your goal?

    Each month?

13. With this calculator, can you get the exact number?

□ Can use □ Cannot use

14. To the right is a picture of a pot for carrying maize flour. It can carry 10 kgs. when completely full. The dotted line shows how much maize flour you purchased in the market. How much flour (in kgs.) do you think is in the pot? _____



The merchant charged Tsh 1.5 k per kg. of flour. How much did you pay in total? _____

15. What does 'saving' mean to you?

16. If you could change one thing about your relationship with numbers and calculating, what would it be?

17. To express our appreciation we would like to give you 10,000 Tsh. Here is m-Pesa. Do you know how to send the money?