Market Information Systems efficiency:

questioning access and use before seeking any impact

Hélène David-Benz[(1)]

Octavio Enriquez Olvera[(2)]

Abdou Rahim Ouedraogo[(3)]

(1) CIRAD, UMR MOISA, TA 60/15, 73 rue J.-F. Breton, 34398 Montpellier cedex 5, France ; benz@cirad.fr,

(2) Master 3A, IRC/SupAgro, 1101 Avenue Agropolis, 34090 Montpellier, France ; pimpollo095@gmail.com

(3) Master Agronovia, UFR/SH, Univ. of Ouagadougou, Burkina Faso ; rahimoued31@hotmail.fr

Paper submitted for oral presentation at the 170th EAAE Seminar
"Governance of food chains and consumption dynamics:
what are the impacts on food security and sustainability"
Montpellier, France, May 15-17, 2019

Summary:

In developing countries, the fast spread-out of mobile phone in rural areas has paved the way for many innovations. Since the early 2000's, most Market Information Systems (MIS) have integrated mobile phone, aiming to improve market information access to small farmers, and thereby to ease their insertion into markets and to reduce their asymmetric position in the face of buyers.

Most recent studies on MIS are focused on impact assessments, using experimental or quasi-experimental methods to analyze the quantitative impact on prices received by farmers. This communication takes a different perspective. It seeks to understand why the use of these MIS remain marginal and to characterize the users and their access constraints. The method includes two steps: an analysis of the flow of information received and transmitted by the MIS server and a light users' survey. It is applied to two case studies, in Burkina Faso and Tanzania.

The results show that the use of these MIS is highly seasonal and concentrated on a few major staple products, despite the wide range of products covered. In addition, most users have only used them on an occasional basis, while regular users are very few. Regular users often turn out to be outreach agents, leaders of farmers' organizations, local officials, rather than small producers. The challenges to manipulate correctly mobile applications for people with very low level of education appear to be a significant obstacle. Beyond the promotion of the tool, the organization of training is a driving force. Targeting intermediate agents, likely to assimilate quickly the use of these tools and to accompany the learning process of smaller famers should be more efficient than targeting directly these latter.

Key-words: Market Information System, ICT, mobile phone, agricultural marketing

Introduction

Since the mid-2000s, mobile phone spread out in an impressive way in developing countries, reaching even the most remote rural areas (Nakasone & Torero, 2016). Its penetration has been particularly remarkable in poor communities and countries, in which ICTs have been previously marginal. Considering the geographical dispersion of rural population and its isolation from major consumption markets, the potential benefits of using mobile phone to better connect farmers to markets drove the attention of ICT4D community (Halewood & Surya, 2012). The opportunity to provide farmers with a diversity of updated information on markets, at very low cost, led to the renewal of interest on Market Information Systems and to an explosion of technical and institutional innovations (Galtier et al. 2014).

Simultaneously, this massive penetration of mobile phone drove a large range of scientific literature on ICT4D, with a growing involvement of different disciplines such as information systems, computer sciences, economics, anthropology, sociology, development studies (Walsham, 2017). Among economists, the focus is mostly put on welfare impact. These quantitative impact assessments, based on experimental or semi-experimental methods, are mainly considering prices and income. Requiring large surveys and econometric skills, and aiming at obtaining results publishable in academic reviews, case studies tends to be based on well-functioning MIS (or to develop their own experimental devises to eliminate as much as possible bias). Demonstrating that a « good » MIS have a positive impact on famers' income is not meaningless, but it is of little use to understand the condition of its efficiency and the pitfalls to avoid. Meanwhile, many MIS face the problem of reaching a significant number of users, mostly if they adopt "pull" systems (in which users chose voluntarily the information they want) rather than "push" systems (in which a generic information is send to a pool of users).

This communication takes another perspective: it explores different methods of rapid assessments of the use of a MIS, to be implemented steadily, at a limited cost, in order to adjust the systems and to better meet the objectives of the targeted users. How far does the information reaches the targets? What type of the information do the users mostly require? Who are the actual users? What do they use the information for? These questions need to be answered to improve the efficiency of a MIS, before seeking to measure its impact.

Literature review

The seminal studies about the impact of mobile phone on agriculture markets, which are often cited as references, does not refer to MIS but rather to the spreading of mobile phone on rural areas. Jensen (2007) showed that, in the Indian province of Kerala, the mobile phone coverage steadily reduced fish price dispersion and waste, hence increased welfare, thanks to a better allocation of fishermen's catches along markets. Aker (2010), analyzing cereal markets in Niger, found that the introduction of mobile phone was followed by a reduction of 10-16% of price dispersion between markets. Indeed, the positive impact of an easier circulation of information among the different market actors, allowed by mobile phone, is largely acknowledged.

When focusing specifically on the impact of MIS that use mobile phones to disseminate information, the results are more heterogeneous. Several authors found a significant impact on the producers' selling prices and quantity sold. Kizito et al (2012) show that in Mozambique, the reception of price information received by radio or mobile phone increases the selling price off maize off 12%. Analyzing the impact of an SMS based MIS in Ghana by a double difference approach, Courtois and Subervie (2014) found that a price increase of 10% for maize and of 7% for groundnut is associated thing SMS reception. Implementing a randomized controlled trial in an highland region in Peru, Nakasone (2013) found that providing mobile phones

dedicated to the reception of SMS on market prices improved the average price received by 11 to 14% (the higher being for more perishable crops and more risk-averse farmers), and makes the farmers more likely to sell their crops. Other authors found no significant impact on price or farmers income: Fafchamps and Minten (2012) on various crops in India; Mitra et al. (2013) on potatoes, in India as well. Beyond the unsteady results of these analysis, it must be underlined that the rigor of econometrical methods bump on methodological challenges when they are applied to measure the impact of price dissemination (Staatz, Kizito, Weber, & Dembele, 2014). Moreover, these studies focus mainly on measuring impact on income (selling price, quantity sold) but they do not bring much understanding of the adoption process of these innovations (whereas one of the main issues is that very few users actually take-up MIS services), and of the mechanism through which information impacts on farms' behavior.

Materials and Methods

The following analyses bare on two MIS, which have been developing mobile phones' applications to collect and disseminate price few years before the investigation: namely SIMAgri in Burkina Faso and MAMIS in Tanzania.

SIMAgri has been set-up by APROSSA, which is a branch of *Afrique Verte* in Burkina Faso. The NGO *Afrique Verte* works since 1991 in Mali, Burkina Faso and Niger, to improve food security. It is focused on cereal markets, supporting farm based organizations and cereal traders through rural micro finance, cereals fairs and market information. In the early 1990's *Afrique Verte* developed one of the first non-public MIS, at regional scale. As in the case of most MIS of the first generation, information was disseminating through radio, boards and emailed newsletters. In the mid-2000's APROSSA shifted to an electronic platform, in order to disseminate information through mobile phone and secondarily by the Internet. The new platform SIMAgri was launched in February 2015. It provides different services: (i) price

consultation (of cereals, pulse grains, roots and tubers, vegetable, fruits, nuts, meat, animal products and inputs, from 62 markets) ; (ii) posting of selling or buying offers (which can be posted by single uses, farmers' organizations or institutions) ; (iii) consultation of these offers ; (iv) alerts[1]. All these services are accessible on request by a standard mobile phone, sending simple SMS. Similar information is available on the web site of the organization. Prices are collected by APROSSA staff or market agents; the bids are directly posted by the users or with the intermediary of the MIS administrator.

MAMIS has been setup by Mviwata[2], a Tanzanian farmers' organization network established in 1994. The core objective of MVIWATA is to unite and strength smallholder farmers' groups, in order to defend their interests and address the challenges of farmers with one voice. The organization is notably involved in strengthening marketing capacities of farmers, investing in the construction and the management of rural wholesale markets. MAMIS (MVIWATA Agriculture Market Information System) was developed in 2010 to enhance food market transparency and to ease the access of market information for market actors, and more specifically for the members of the organization. As SIMAgri, MAMIS provides access to current market prices, as well as seller and buyer bids, but only through mobile phone. More than 40 commodities are followed (covering cereals, roots and tubers, oil seeds, vegetables, fruits, spices, seafood), in 27 different markets. Price data is collected at market level by market agents, that might be directly related to Mviwata or not, and which are not paid for this task.

In both cases, access to information is based on so-called *pull* systems (the information is extracted for the system by the users) and the users are charged as for an SMS. No SMS are

[1] The alerts are sent automatically to anyone how is registered to SIMAgri. It provides general information as fairs, special events, notification of training sessions etc.

[2] Mviwata : *Mtandao Vikundi vya Wakulima wa Tanzania* (National Networks of Farmers' groups in Tanzania)

automatically sent to users (known as *push* system). Users have access to the platform through a phone number and have to formulate their request sending an SMS with a specific syntax, defining if they want to get prices or to set/get an offer, and then identifying products and markets (ex : for SIMAgri “getprix#mil#bobo” to receive the price of millet in Bobodioulasso, “setoffre#v#soja=100/t+320000/PU” to send a selling offer of sojabean ; for MAMIS “*bei mahindi morogor*”, to obtain the price of maize in Morogoro). When not market is specified, all the available prices are sent.

Our analysis was implemented in two steps: (1) the exploration of all the messages received by the server, from the start-up of each MIS (to measure frequencies, seasonality, diversity of requests); (2) a short phone survey, to briefly characterize users and to get their appraisal of the service.

For SIMAgri, a total of 88 287 messages were received and sent between May 2013 and March 2015. For MAMIS, the case study bears on 51 893 messages received and sent between September 2010 and April 2016.

The analysis of the flow of messages relies on basic descriptive statistics. The main challenge was to get the databases, in a workable format. It appeared that the extraction of such data, if not initially included at the conception stage of the application, cannot be done by the MIS managers, which are generally not ICT specialists. In one case we had to refer to the person in charge of the server, witch is located in Europe, and in the other case to the computer programmer that developed the application. Several weeks have been needed to obtain the databases and additional time to turn the data into an exploitable format.

For both MIS, as no registration is compulsory to access to the services, no list of the users is available. The sampling bases for the phone surveys had to be elaborated on the base of the phone numbers associated to each message received. A first exploration of these sampling bases

showed that a very large share of users sent only very few messages and then drop the system (see results below). A fully random sampling would have probably miss the more steady users, which are few. Thereby, the samples have been stratified according to the frequency of the messages, with a higher rate of sampling for the more frequent users (see appendix). The number of question was very limited, in order not to exceed 10 minutes of interview. The size of the samples was also small (112 in Burkina Faso and 165 in Tanzania), the objective being to implement rapid surveys to identify the constraints of use, rather than characterizing the users in detail. Though a limit of these surveys is that they do not provide enough data on socio-economics characteristics of the users to explore causality links between the users profile and the way they use the MIS.

Results

A very seasonal use

The analysis of the number of messages received by the server of SIMAgri indicates that the activity is very seasonal, varying from a maximum of 400 messages per month to almost null (cf. Figure 1). It is strongly related to the marketing season of the cereal crops in Burkina Faso: millet, sorghum and maize are harvested from September to December, and marketed along the following months. The activity increased after the first year of launching the system but remained at a limited level.

For MAMIS, the frequency of the requests is also strongly seasonal, clearly linked to marketing high season, with a maximum up to more than 1000 messages per month in August or September (Figure 2). After a relatively active period between 2013 and 2015, the pace of the messages slowed down mid-2015. This can be attributed to a change of the MIS administrator and to some technical problems that arose.

Figure 1. Evolution of messages received by SIMAgri

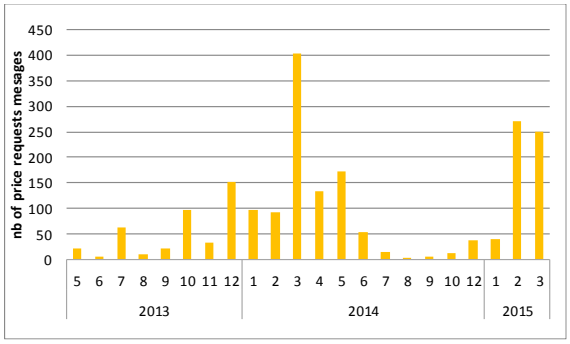
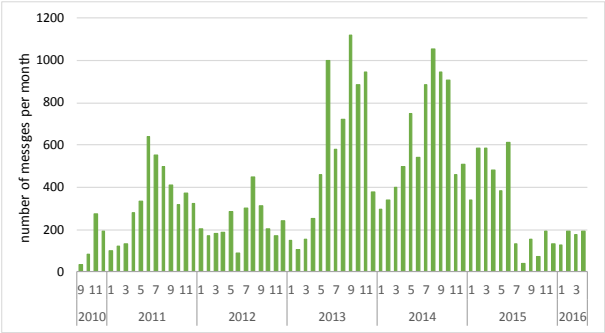


Figure 2. Evolution of messages received by MAMIS



In both cases, a few trainings were organized for farmers groups and in rural markets. Posters and leaflets were disseminated, with explanations on the way to use the information services. According to our survey, 85% of the users discovered SIMAgri throw a training and the number of users are the most important in the two regions where most trainings were organized. In the case of MAMIS, 60% of the users discovered the system through marketing training, other meetings organized by Mviwata or through Mviwata field outreach.

Developing information tools and collecting information is far from enough. MIS needs to elaborate their strategies to promote the services and to ease their adoption.

A concentration on the main staples

For SIMAgri as for MAMIS, the interest of the users go essentially to a few member of staples. Whereas very large number of products are covered, only seven products are included in more than 2% of the request messages. In both countries, the requests are concentrated on one leading product: the maize, which is present in 47% of price messages received by SIMAGri and 32% by MAMIS, followed by the other main staples (Figure 3 and 4). This partly reflects the share of these products in the national production, but aswell the market orientation of the products. In Burkina Faso, maize consumption has been growing very fast over the two last decades, whereas sorghum and millet, the two traditional leading staples, have been stagnating, and recently decreasing. The share of maize on price requests reflects this dynamic of maize on markets, whereas sorghum and millet are far behind, in second and third position. Similarly, in

Tanzania, the maize production has been overpassing the one of cassava, which use to be the major staple (Table 1). Although still close in term of volume of production, the latter is much less marketed and lags far behind with less than 2% of the requests, as for sweet potatoes and banana, two other major staples.

Conversely, some marginal products in term of production, but specifically oriented towards markets, are relatively frequently requested. It is the case of sesame and soybeans in Burkina Faso and of onion and tomato in Tanzania (Table 1).

Figure 3. Share of price requests by product (SIMAgri)

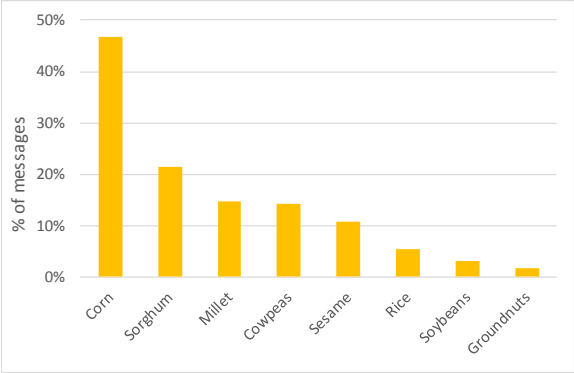


Figure 4. Share of price requests by product (MAMIS)

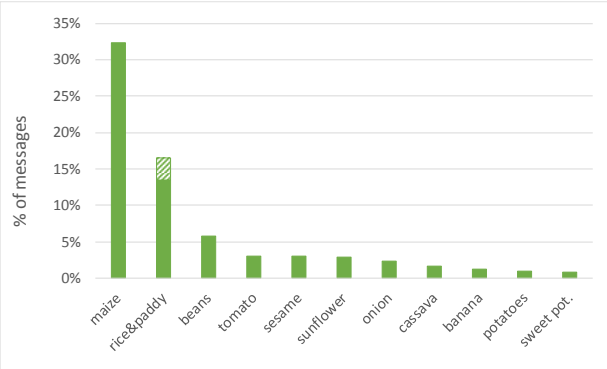


Table 1. Number of consultations by products

Burkina Faso / SIMAgri				Tanzania / MAMIS			
	Number of requests per year	Production (t)*	Nb of requests / 100 000 t		Number of requests per year	Production (t)*	Nb of requests / 100 000 t
Maize	506	1 509 252	34	Maize	1 129	5 488 279	21
Sorghum	231	1 794 039	13	Rice & paddy	574	1 539 787	37
Millet	159	1 025 555	16	Beans	202	1 061 036	19
Cowpeas	154	581 267	27	Tomato	103	421 364	25
Sesame	116	229 592	51	Sesame	103	830 347	12
Rice	59	326 442	18	Sunflower	99	2 034 080	5
Soybeans	33	18 414	179	Onion	83	183 256	45
Groundnuts	18	342456	5	Sweet potato	28	3 403 395	1

*Average production for period analyzed in each country: 2013 to 2014 in Burkina Faso, 2011 to 2015 in Tanzania (source: FAOSTAT)

The diversity of product covered is a delicate issue. On the one side, farmers are willing to obtain information about all the products they sell. On the other side, a large number of products is often to the detriment of the quality of the data. Yet the quality of data is mandatory to satisfy

users' needs and it requires methodological rigor as well as constant checking (that cannot be done fully automatically). So it doesn't appear relevant to aim at covering a too large range of product. Mainstreaming on major products, and on those which have a special marketing interest, might be more effective (at least until the system is running properly).

Requests on prices remain dominant

Apart from providing price information, both systems offer the possibility to post selling or buying offers. If another user is interested, the MIS provides the phone number of the announcer in order than a direct contact can be established. This can be assimilated to an electronic broker; it is seen as one the most promising innovation of the MIS based on mobile phone, allowing direct matching between sellers and buyers (Galtier et al., 2014). Finding more buyers is indeed one of the main expectations of the farmers (see below). However, somehow surprisingly, bidding services are very marginally used. For SIMAgri and MAMIS, respectively 85 and 82% of the messages are standard price requests. Only 2 to 3% are buyers' offers, and the remaining are sellers' offers (respectively 12% and 16% in Burkina Faso and Tanzania). The producers appear to be more in search of enlarging there commercial network that the traders. That is rather consistent with the fact that they often suffer from the lack of choice between buyers, due to their remoteness.

The very limited use of these selling and buying bids can be explain by several factors. (i) The lack of knowledge of the service (due to its limited promotion and its more complex use than the price information). (ii) The fundamental role of personal relationship in the trade of agriculture products to secure transactions in multi-risk contexts (Bardhan, 1989 ; Fafchamps & Minten, 1998 ; Gabre-Madhin, 1998 ; Moustier et al., 2004) ; although information imperfection on prices is supposed to be solved by the MIS, many sources of risk remains (heterogeneity of the quality, lack of enforcement solution in case of failure…). (iii) The large share of interlocked transactions, due to the lack of credit market. Previous studies show that

even having access to MIS price information, farmers use it rather to feel more confident, checking that their usual commercial partner are not cheating them, rather than to shift to a different buyer and/or to change the place where their sell (Wade, 2009).

Direct matchmaking between farmers and buyers, through fairs or special events, as the cereal fairs organized by *Afrique Verte* before every marketing season, are probably a more relevant way to reinforce and diversify marketing relations than only disseminating unpersonal bids.

Regular users are few

The analysis of the frequency of messages by phone number reveals that a majority of the users only test the devise few times and then give-up. Even if the number of users registered by the MIS is unneglectable (427 in less than two years for a SIMAgri, 7209 in more than 5 years for MAMIS), most of them have just tried the systems but didn't go further (Figure 5 and Figure 6). Either because they could not manage to formulate correctly their requests, or because they did not obtain a satisfying information.

Figure 6. Distribution of SIMAGri users, according to the number of messages sent

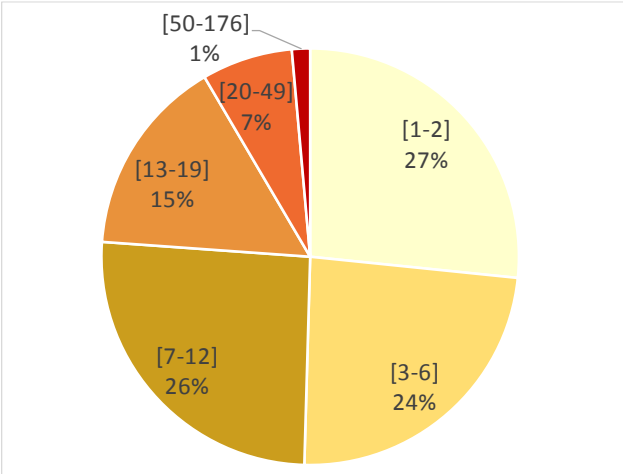
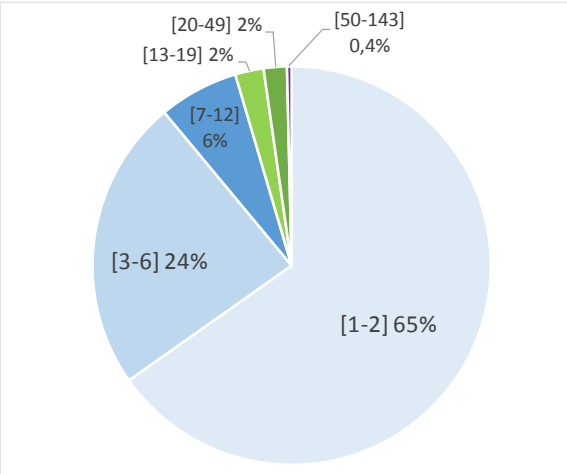


Figure 5. Distribution of MAMIS users, according to the number of messages sent



In the case of SIMAgri, nearly one third of the users surveyed declare having troubles in using the SMS devise. Among these, the main problems (for half of the users that have trouble in using the SMS devise) are the reception of messages (which can be due to incorrect typing of

the request, missing data in the database or temporally failure of the system) and the bad coverage of the mobile network. Difficulties in typing the codes comes in third position (one quarter of the users that have troubles).

In the case of MAMIS, among all the surveyed users, the reason of unsatisfaction were for about one third of the sample that the price was unsteadily available or not available for the required product. For about 10% of the sample, the choice of markets or the reliability of prices was unsatisfying. Although very few declare having troubles in typing the requests, the analysis of the messages shows a large share of improper messages, that the system was not able to recognize.

The technical accessibility of the tools are definitely crucial to reach smallholder farmers. Learning process needs to be supported by trainings and direct interactions between users. Besides, MIS team have to better identify the reasons of dissatisfaction, distinguishing technical problems of access, the quality of the information received (missing data, obsolete data, lack of reliability), the lack of interest for the information or the inability to use it.

A diversity of users

The phone surveys indicates than at least two thirds of the users are famers, which are indeed the first targets of these MIS. However, in Burkina Faso, where APROSSA is very active in supporting cereal trade, 25% of the users are traders or processors, which is linked to the involvement of the APROSSA, which sat-up the MIS, in supporting cereal traders. In Tanzania, the share of traders among the users in lower (9%), but 18% of the users are organization leaders (farmers' organization leaders, local representatives, etc…) or people involved in agriculture training. These categories of users, not directly involved in the value chains, are getting information not primarily for their own use, but rather to share it with farmers they are working with. It is interesting to note that among these categories, the share of "testers", that give-up after few trials, is much lower than among farmers, and that the rate of frequent users is higher.

They have the capacity to understand easily the features of the tool and to explain its use to the farmers. Whereas MIS often target directly farmers, putting more emphasis on these intermediaries, whose level of education is generally higher, could better value they role of knowledge brokers.

What is the information used for?

Measuring the impact of the information received cannot be the scope of a rapid phone survey. The surveys rather focused on what did getting better information changed for the users. Declarative statements always need to be taken cautiously, considering the possible bias related to a confusion (conscious or unconscious) between expected uses and actual uses. However, results show that they provide valuable indications to adjust the offer of services.

Multiple choice questions were asked, with slightly different options for farmers and for traders in Burkina Faso. Enlarging the commercial possibility appears to be the main achievement for all the actors in Burkina Faso, either through new partners or through new products (Figure 7 and Figure 8). It might seem contradictory with the fact that selling/buying bids are little used (12% of all the messages received by the server). It might be not the new contacts provided by the MIS that make the difference. In the case of farmers, the diversification of partners might be interpreted as a strengthening of self-confidence, supported by a feeling of better negotiation capacity, which pushes them to search for other buyers. In the case of buyers, it might be a larger geographical overview of the market, that pushes them to diversity the places of collection, and hence this way to find new sellers. In both cases, actors stressed the saving of time: less time spent to get information on the market situation going to market places, or calling relatives, or discussing with neighbors.

Figure 7. Use of information by farmers, breaders, outreach agents (Burkina Faso)

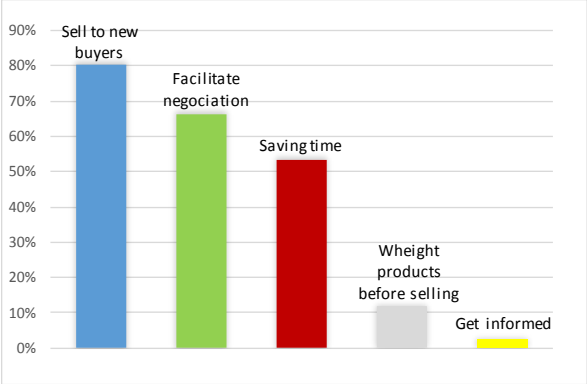
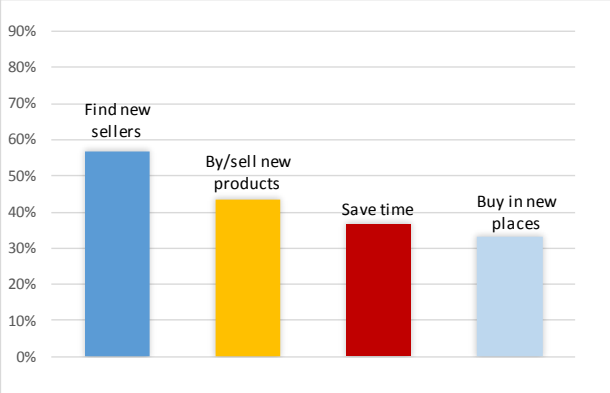
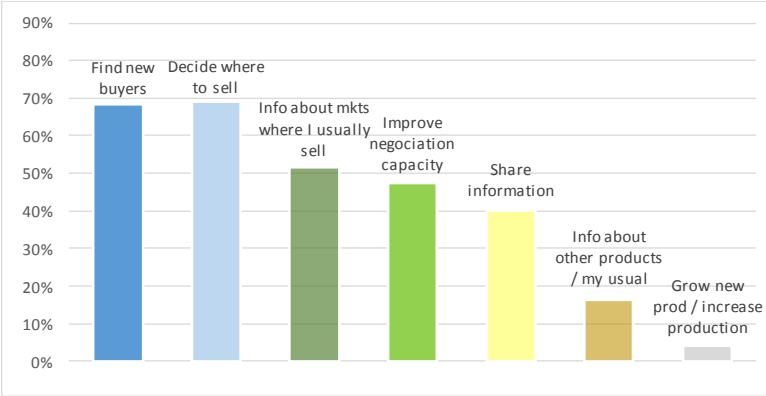


Figure 8. Us of information by traders and processors (Burkina Faso)



In Tanzania, the number of traders surveyed was too small to be analyzed separately. The following results only bear upon farmers and organization leaders (Figure 9). Opening up the choice (new buyers and different places to sell) appears as well as the major output of getting information through MAMIS. Using the MIS to get information about the markets they usually go reflects the simple need of being more confident, cross checking different sources. It is likely to be associated to better negotiation capacity, that comes in fourth position, and can lead to the possibly of finding new buyers in the usual market. The importance of sharing information stresses the issue of socialization of this new knowledge.

Figure 9. Use of information for all users (Tanzania)



Discussion

Adapt the technical layouts to the users

The slow take-up of the mobile phone devises developed by MIS can been seen as a paradox, considering the abundant literature pointing how the lack of access to market information contributes to the asymmetric position of farmers and to higher transaction costs. However, a closer insight to the way these devised are used can explain the gap.

Technically, although simple to manipulate in the view of their designers and IT developers, their technical layout are not obvious for a public with a low level of literacy. The two MIS studied have developed tools that are based on sending request messages (*pull* systems). This option implies that the users are able to formulate correctly the requests, with the right syntax and the right spelling. Even is the system is as flexible as possible, in order to accept a large range of mistakes, it still implies a certain knowhow to formulate requests which the system can understand. Another option for *pull* systems is to develop tree menus tools, which avoid the typing of request messages by the users and the mistakes associated with them. All the options are then displayed, step-by-step. A growing number of MIS are adopting this format, as BazarMada in Madagascar or ZNFU in Zambia. But it rapidly becomes heavy to manipulates, when several steps are needed to get the price of one single product in one specific market. And more diversity of information is offered, more the manipulation of the tool becomes heavy.

Developing tools which are really “user friendly”, simple enough to be within the reach of a large majority of rural population, is indeed a challenge. The conception of such MIS, as other ICT4D tools, requires close collaboration of two very different knowledge communities: computer sciences and development socio-economics. The supposedly interdisciplinary approach bumps on very different ontology and epistemology: disciplinary values, ground of validity and terminology (Burrell & Oreglia, 2015). These miss-understanding leads to

inconsistency between the technological potential of ICTs (pushed by the commercial expectation of mobile phone companies) and the actual capacities of rural actors.

Besides, the learning process required to be able to use efficiently these devises is under considerated by MIS designers and developers. The use of second generation MIS cannot expand "spontaneously". A large promotion of the system and their features is necessary, either throw radio, television, posters on market places, leaflets etc. But it is far from enough. Training appears to be critical. The first issue is to be able to manipulate the tool and to have access to its content. Then, several steps come afterwards: understanding the meaning of the information, being confident about it (which requires at least to identify and acknowledge its source), knowing how to use it and finally being able to incorporate it into decision-making. Apart from the most experienced and educated farmers, going throw these different steps requires training, discussions, exchanges of experiences with pears. Even if basic trainings, to be able to manipulate the tool, can be disseminated at large scale through leaflets or radio, it seems difficult to go through the whole process without face-to-face interaction with trainers and experienced users. As stressed by Garuku et al. (2009) horizontal transfer of knowledge (throw participatory research, utilizer groups, learning-by-doing) plays a crucial role in capacity building processed related to ICTs in agriculture sector. Intermediaries (outreach staff, farmers' organization leaders) are critical targets to focus on. Called knowledge brokers by Gebremedhin et al. (2006), they have the capacity to understand easily the functioning of mobile applications as well as their content, they are able to convey the know-how and the knowledge to the final users. In the case of ITC tools, the users are not able to adapt the innovation; adequate institutional mechanisms (such as innovation platforms) should be developed between users, managers and technical developers, in order to pull-up the needs of adaptation.

Insuring quality and availability of data

Beyond the issue of the accessibility of the data, its availability and quality is critical. The almost boundless possibilities offered by electronic data collection, processing and dissemination have prompted MIS to expand the diversity of product covered, the marginal cost of an additional product being at first sight neglectable. However, results show that even when considering a nation scale MIS, the users demand is strongly concentrated on few main products. Moreover, price series of more marginal products are often incomplete (either because they are not always available or because price collectors are less cautious about them) and when facing missing information users are rapidly discouraged. Indeed, the quality of data requires a close follow-up: training the data collectors, supervising then steadily (by phone and on the field),providing them motivating conditions, check the consistent of the data by build-in automatically tests. Cleaning-up the data-bases properly cannot be done fully automatically: it requires steady analysis of the series and a good knowledge of the markets to dig up outliers. Focusing on a limited number of products, well worked-out, is thought much more efficient than trying to embrace too many.

Furthermore, even very accurate, daily prices are not enough. In the case of very perishable products and unstable markets where prices fluctuate daily (even from the opening to the closing of the market), price data is always more or less outdated. In the case of storable goods, for which the farmers' dilemma is whether selling now or latter, what matters is the trend, rather than the daily price. But providing trends requires an analysis of the data and a good knowledge of the market, with again cannot be feasible on a large range of products.

What use to be the core outputs of public MIS of the first generation, namely providing stead analysis of the markets of the main staples, has little been integrated by the new generation of MIS (Galtier, David-Benz, Subervie, & Egg, 2014) and adapted to the potential of mobile phone applications. However, a few innovative experiences provides promising results. N'kalo, which

operates in Côte d'Ivoire, Mali, Senegal and Burkina Faso, provides for cashew nuts and sesame trends, forecasts and advises on whether selling or storing, which recipient farmers take into consideration, much more than daily prices (Puvilland, 2018).

A need of monitoring to adjustment of the devises

Technical possibilities offered by mobile phones and electronic platforms are extremely wide. But adapting these tools to the needs and the capacities of the final users, whereas implementing viable business models, is far from obvious. It implies an iterative process of adjustments, taking into consideration the effective use of the tools and the reactions of the users. The traceability of the use (i.e. memory of all the flow of messages), in the case of *pull* systems, is in that way a precious asset. Simple indicators can be periodically generated and analyzed, to monitor the device, highlighting strengths and weaknesses and providing guidance to adjust not only the technical tool but as well the institutional and organization features surrounding it. However, few MIS are actually taking advantage of this monitoring potential. Whereas standard economic impact evaluation, which are the focus of most scientific publications, requires significant means and specific econometric skills, the analysis of the flow of messages could be in most cases internalized by the MIS or its hosting institution. However, it implies that the possibility to extract the flow of messages would be consider within the design phase, which is seldom the case.

Phone surveys, although limited to few questions, provide some indications on the diversity of the outcomes perceived by the users and on the users themselves, which are not limited to the direct actors of the marketing chain. Enlarging the choice (of buyer or seller, of place where to sell), saving time, sharing information, might be not directly translatable into better prices. It can have effect on loses, on the allocation of time, on strengthening of farmer leaders, on self-confidence… on the medium or the long term. Getting steady market information through MIS, mostly if they are not limited to daily market prices, can have an impact on the capacity of

choice, in the sense of A. Sen capabilities. It would require broader angle of analysis than just focusing on selling prices as a proxy of well-being. These perspectives of research, opened notably by Duncombe (20016) in the field of ICT4D, have little been explored when applied to research on ICTs for Market Information Systems.

References

Aker, J. (2010). Information from markets near and far: mobile phones and agricultural markets in Niger. *American Economic Journal: Applied Economics, 23*.

Bardhan, P. (1989). *The economic theory of agrarian institutions.* Clarendon Paperbacks.

Burrell, J., & Oreglia, E. (2015). The myth of market price information: mobile phone as the application of economic knowledge in ICTD. *Economy and Society, 44*(2), 271-292.

Courtois, P., & Subervie, J. (2014). Farmer bargaining power and market information services. *Amer. J. Agr. Econ.*, pp. 1-25. doi:10.1093/ajae/aau051

Duncombe, R. (2006). Using the Livelihoods Framework to Analyze ICT Applications for Poverty Reduction through. *Information Technologies and International Development, 3*(3), 81-100.

Fafchamps, M., & Minten, B. (1998). *Relationships and traders in Madagascar.* Washington DC: IFPRI.

Fafchamps, M., & Minten, B. (2012). Impact of SMS-Based Agricultural Information on Indian Farmers. *The World Bank Economic Review*.

Gabre-Madhin, E. (1998). *Transaction Costs, Contractual Choices, and Institutions in the Ethiopian Grain Market.* Stanford: Stanford University,.

Galtier, F., David-Benz, H., Subervie, J., & Egg, J. (2014). Agricultural market information systems in developing countries: new models, new impacts. *Cahiers Agricultures*, 232-244.

Garuku, M., Winters, K., & Stepman, F. (2009). *Inventory of innovative farmer advisory services using ICTs.* Accra: FARA.

Gebremedhin, B., Hoekstra, D., & Tegegne, A. (2006). *Commercialization of Ethiopian agriculture:extension service from input supplier to knowledge broker and facilitator.* Nairobi: IPMS/ILRI.

Halewood, N., & Surya, P. (2012). Mobilizing the Agricultural Value Chain. *Maximizing mobile*, 31-43. The World Bank.

Jensen, R. (2007). The Digital Provide : Information Technology, Market Performance, and Welfare in the South Indian Fisheries Sector. *The Quarterly Journal of Economics*(1223), 879–924.

Kizito, A., Donovan, C., & Staatz, J. (2012). Impact of Agricultural Market INforaiton Systems Activities on Market performance in Mozambique. *Working Paper 124*, 60 p. MSU/AEC.

Mitra, S., Mookherrjee, D., Torero, M., & Visaria, S. (2013). *Asymmetric Information and Middleman Margins: An Experiment with West Bengal Potato Farmers.* Mimeo. Boston, MA: Boston University.

Moustier, P., Vagneron, I., & Bui, T. (2004). Organisation et efficience des marchés de légumes approvisionnant Hanoi (Vietnam). *Cahiers Agricultures, 3*, 142-148.

Nakasone, E. (2013). *The role of Price Information in Agricultural Markets: Experimental Evidence from Rural Peru.* University of Maryland.

Nakasone, E., & Torero, M. (2016). A text message away: ICTs as a tool to improve food security. *Agricultural Economics, 47*, 49-59.

Puvilland, C. (2018). *Rapport d'évalution des impacts de l'informations de marché au Sénégal.* Lyon: Nitidae.

Staatz, J., Kizito, A., Weber, M., & Dembele, N. (2014). Challenges in measuring the impact of Market Information Systems. *Cahiers Agricultures*, 317-324.

Wade, I. (2009). *Systèmes d'information de marché, coordination et gestion des risques dans les filières agricoles : cas des produits maraîchers au Sénégal.* Montpellier: SupAgro, Univ.Montpellier I.

Walsham, G. (2017). ICT4D research: reflections on history and future. *Information Technology for Development, 23*(1), 18-41. doi:10.1080/02681102.2016.1246406

APPENDIX

Stratified sampling

SIMAgri – Burkina Faso

Number of SMS per user	Number of users	% of total users	Size of sample	Sampling %
1-2	116	27%	18	15%
3-6	103	24%	15	15%
7-12	112	26%	17	15%
>= 13	103	24%	50	49%
Total	434			
Trained	219		22	1%
Total sample			122	

MAMIS - Tanzania

Number of SMS per user	Number of users	% of total users	Size of sample	Sampling %
1-4	5910	82,0%	53	32%
5-9	829	11,5%	50	30%
10-19	307	4,3%	25	15%
20-39	122	1,7%	24	15%
40-99	35	0,5%	9	5%
100-150	6	0,1%	4	2%
Total	7209	100,0%	165	2%