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**The Myth of Market Price Information: Mobile Phones and Epistemology in
ICTD**

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Abstract: The notion that farmers use mobile phones to acquire market price information has become a kind of shorthand for the potential of this technology to empower rural, low-income populations in the Global South. We argue that the envisioned consequences of 'market price information' to market efficiency with benefits at all income levels is a kind of myth. This myth frequently promulgated by mass media outlets such as *the Economist*, is also the subject of serious discussion among scholars. The idea has become a kind of boundary object recast within the epistemic cultures of economics, computer science, policy work, and development expertise. We draw from our ethnographic work (among rural agriculturalists in China and Uganda) to offer four alternatives to this myth.

Keywords: epistemology; mobile phones; China; Uganda; markets; agriculture

The Myth of Market Price Information: Mobile Phones and Epistemology in ICTD

The mobile phone as a platform for information dissemination, and in particular, market prices, has become a kind of shorthand for the technology's transformative possibilities for low-income, rural populations in the Global South. The core question of how information may be linked to productivity, income, and more broadly market efficiency and economic growth at the national level, however, is still an active area of research and is far from a settled matter. A study that has come to define research in this area, Robert Jensen's econometric analysis of coastal fish markets in Kerala, India, shows improvements to market efficiency and more stable prices with the arrival and use of mobile phones, a consequence, he proposes, of improved circulation of information (Jensen 2007). Other social scientists have offered refinement and critique of this notion, often pointing to the necessity of trust between trading partners in market exchange that complicate notions of how trade might be enhanced through impersonal 'information' circulation (Aker and Mbiti 2010; Molony 2007; Jagun et al. 2008; Donner 2007). The notion of the mobile phone as platform for market price dissemination has also quickly been turned toward the application space through the combined efforts of system and software developers, mobile network providers, and NGOs. Often referred to as market information services (MIS), such systems are designed as database repositories frequently using text messages (SMS) as the mode of information delivery.ⁱ Recent evaluations of such services, however, have shown disappointing results. In particular, economists employing the same form of empiricism as in Jensen's initial study find low adoption rates and no measurable improvement to the price acquired by users of such services.ⁱⁱ How do we reconcile the compelling evidence and analysis of the impact of mobile phones on market efficiency presented in the promising early studies, and the disappointing results of subsequent MIS?

Our analysis seeks to answer this question by turning attention to practices of representation and knowledge-building in the emerging interdisciplinary field of information and communication technologies and development (ICTD). Additionally we draw from our own qualitative research on trade, livelihoods, and mobile phones among low- to medium-income rural fishermen and fish traders in Uganda, and farmers in Northern rural China. We argue that this vision of market efficiency achieved through information in general, and market price information in particular, hides a wide variety of marketing and trade practices that do not entirely fit this efficiency-driven model. The design of MIS often fall short in supporting the practices of lower income agriculturalists and traders in particular. In interviews where we employed an open-ended line of questioning, when given the opportunity to describe their key decision-making points and general practices of marketing their goods, our informants consistently disclaimed any practice of price comparison between markets (by phone or other means) with a few rare exceptions. However, in Uganda, fishermen and fish traders still described the mobile phone as critical to their trade activities. In China, by contrast, farmers found little use for the mobile phone in agricultural activities, even though mobile phones are widely available and actively used for other purposes. The explanations we offer

regarding the role of mobile phones in farmers' and fishermen's activities do not wholly refute findings on this topic derived from econometric analysis. Rather, they show how the alternate behavior of these market actors is logical – and sometimes inevitable - in the context of available resources and pressures related to their socio-economic circumstances and the social setting of village life that shape livelihood strategies.

The argument of this article is developed in two main sections. In this first section we consider how the literature on the use of mobile phones in market activities is produced by researchers with different disciplinary affiliations, and how their different epistemic cultures (Knorr-Cetina 1999) contribute to create the 'myth' of market price information. In the second section we present an analysis of our own ethnographic work, bringing the voices and practices of rural market actors to the fore to present four alternatives to this myth.

SECTION 1: BIRTH OF A MYTH

The Community of ICTD: Epistemic Cultures and Boundary Objects

The emerging field of ICTD brings into contact many different types of experts and professionals (from academia, research institutes, NGOs, aid agencies, and the commercial sector) with different forms of institutional backing and warrant for their work. They share an interest in understanding how digital technologies may help to realize development outcomes, by whatever definition one might attach to 'development.' ICTD can itself be identified as a community but in a rather broad and loose sense. It is not contained by any one institution and while there are moments of co-location (if infrequent), none bring the entirety of the community together at one time. Key contributors to its ideas and discourse do not all recognize or identify themselves as members. Our concern is with how the ideas that become common reference points are understood and applied by diverse players within this community.

Difficulties and problems arise, in part, from the multiple challenges of this profoundly and chaotically interdisciplinary field. One challenge has to do with disciplinary values, i.e. what members of different fields consider to be the priorities in the pursuit of knowledge and practice (Burrell and Toyama 2009). A second is validity, i.e. what members of different disciplines consider to be compelling evidence or a convincing argument. The third relates to communication and to the terminology and common reference points (case studies, publications) that develop as a kind of shorthand within a discipline, but that may distort work as it moves between groups. By examining the particularly widespread notion that farmers use mobile phones to seek market price information, we seek to concretely specify some pitfalls of interdisciplinarity, and some challenges that stem from the involvement of NGOs and commercial entities in building market information services based on academic research findings.

Abbreviated communication and an incomplete understanding of the conventions that develop within a discipline by scholars and practitioners rooted in different epistemologies can lead to the misinterpretation of research findings as well as practical applications that fit the theoretical model but not the actual

practices of market actors. “Market price information” has come to serve as a *boundary object* of a conceptual (rather than physical) sort. A boundary object is, “both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites.” (Star and Greisemer 1989, pp. 393). Such objects have a common representation between diverse groups (such as economists and computer scientists or academics and practitioners) within a given community, but are “weakly structured in common use” (*ib.*). Subgroups of the broader community develop a deeper understanding of a boundary object, but it “cannot be translated in a satisfactory way into terms used by other groups, since it reflects a different way of acting in the world (a different ontology and epistemology)” (Bannon and Bodker 1997, pp. 4). Therein lies a problem as such boundary objects can potentially lead, “to serious problems caused by the loss of the interpretive context which goes with the representation or information” (*ib.*). The boundary object that we consider here is a conceptual model that relates market actors, commodities, and tools linking them together by a set of posited relationships. In this model, the mobile phone becomes an ‘information delivery platform’ and market price is presented as the singular focus of market-related decision making.

Economics and computer science are two key disciplines that come together in the space of ICTD. They bring to this new space their distinct epistemic cultures which exhibit some differences in procedures and guiding principles in the ways they “create and warrant knowledge” (Knorr-Cetina 1999, pp. 1). One divergence is in the way they test ideas: economists through parsimonious models; computer scientists by building working systems. The purpose of work done by economists to understand mobile phones and the circulation of information in markets is not to offer ‘user requirements’ for system-building. There is not enough information in such models to do so. Yet the pithy and memorable formulation of *farmers acquiring market prices via mobile phone* and thus getting a better price for their crops has done just that -- informed and justified the building of various market price services.

As mentioned, recent evaluations show poor rates of adoption, and a limited impact of SMS-based market price information services (Fafchamps and Minten 2012; Camacho and Conover 2011). One partial explanation we offer from our research findings is that abstracted ‘information’ often loses its usefulness once it is extracted from actual trade relationships and presented impersonally (for example, as an SMS message) apart from any commitment from a buyer to pay the reported price. In fact, the context of the empirical work from which the case for market efficiency through price information was derived did not consist of impersonal information exchanges, but person-to-person voice-based phone calls (Jensen 2007). Our empirical work shows that in similar circumstances – i.e. phone calls between traders or buyers and sellers – information about prices is only part of what is being communicated. The extra details of the conversation are excluded from economists’ models in order to communicate new insights parsimoniously, according to discipline-specific practices of knowledge building. Yet in the translation between disciplinary approaches in ICTD, person-to-person phone calls in which market prices were communicated become SMS messages in which the personal and business relationships between callers are dispensed with.

A second explanation stems from the aggregation and homogenization of agriculturalists into a single category. Intervention work in the development field has long attempted to differentiate between benefits that accrue to small-scale farming operations and lower income members of a sector and benefits that go to medium to large-scale operations and more affluent members (Prahladachar 1983). This differentiation is not lost in Jensen's work, which explains in footnotes the diversity amongst the fishing 'units' studied, and which attends in the analysis to the "welfare effects" for small vs. large-scale fishing units. Higher profits were realized by all fishermen as fish came to be distributed more efficiently, but some fishermen realized these profits without directly using the phone.ⁱⁱⁱ However, system builders in ICTD are generally interested in the way different classes of users might benefit *directly* from the phone. We find the smaller-scale market actors, the low-income farmers and fishermen who own few or no assets, have less ability to act on better information about market price related to a reasonable reluctance to take on risk and a lack of resources, such as having enough working capital to fund travel to distant markets. This does not mean they fail to benefit from the mobile phone, but they do so in entirely different ways. Fishermen mention being able to contact rescuers when caught in a storm or attacked by pirates as a critical life-saving use of the phone (Abraham 2007; Sreekumar 2011). Furthermore, the translation of economic insights on the value of market price information into SMS-based market information services, introduces literacy barriers that further exclude lower-income agriculturalists (often the least educated) though they are often the ones purportedly targeted by such a service.

Notes on Method

We may speak now of our own epistemic culture, as social scientists with an interpretivist approach and more specifically as ethnographers. As such, we place central significance on the explanations of fishermen and farmers themselves, the meaning and motive they attach to their actions, and the richness of direct *in situ* observation of their activities and phone use, despite the confounding complexity that this typically reveals. What economists investigate as 'mechanisms' are referred to by sociologists and anthropologists as 'processes' or 'practices,' the latter term in particular emphasizes a stronger sense of agency in the work done by human actors (Knorr Cetina et al. 2001).

Given the prominence that our own epistemic culture puts on closeness to the phenomenon (over indirect measurements), interlinkages (rather than isolated variables), and rich detail, our ideal data is observational (i.e. overheard phone calls, activities unfolding in the marketplace, etc), complemented by interviews where interviewees draw primarily from their personal experience. The examples and specific quotes we offer, while individual, are presented to characterize the general thrust of our broader conversations in these field sites. In other words, these are not the odd exceptions, but rather common descriptions of trade practices that were recurrent in our respective field sites.

The data generated through our research approach (field notes, photos, interview transcripts) is meant to offer a more vivid sense of the populations meant to benefit from mobile phones in terms of market access, especially farmers and

fishermen, and to understand their priorities. In particular we looked broadly at the ways the phone was used in conjunction with trade along the supply chain – including front line farmers/fishermen, middlemen/wholesalers, and retailers. Our mode of questioning was aimed at grounding views in personal and direct experience. We do not treat our qualitative findings as directly commensurable with the relevant prior econometric analysis in this space, but rather as complicating such parsimonious renderings in a way that may highlight possible alternate interpretations of the findings that may not be visible from any single methodological approach.

SECTION TWO: A COUNTER NARRATIVE

Alternative Takes On the Mobile Phone in Agriculture and Trade Activities

We have identified four ways in which market price information is construed in the ICTD context and in popular debate. Here we provide an alternative reading of these myths by focusing on how fishermen and farmers describe the role that prices play in their decision-making about trade, the role that mobile phones play (or do not) in acquiring price information, and how regulatory and political frameworks influence all business decisions.

The counter-narrative arising from our own empirical work suggests that the myth of market price information is four-fold: (1) the notion that information critical to decision-making is scarce and actively sought after by farmers/fishermen/small traders in rural settings; (2) that in their key decision-making practices, market price is the most critical piece of information; (3) that improvements in market functioning that follow from the arrival of mobile phones necessarily stem from the acquisition of market price information (and not other kinds of information); and conversely (4) that the provisioning of market prices defines mobile phones major impactful application in the context of rural trade activities. By referring to this as a ‘myth’ we use the term in the anthropological sense, as a compelling story of origins – here the origins of a community (ICTD) and of the mobile phones promising introduction into poor economies of the Global South, seen from a Western popular perspective and often reflected in mass media outlets such as *The Economist*.

Phone use diverged between our two field sites. In Uganda, we find value offered by the phone for market actors across a whole range of roles and activities. In China, smallhold farmers find value in mobile phones almost entirely apart from business purposes. In both our field sites, ‘information’ in general was not perceived by farmers and fishermen to be absent or lacking. Market price information more specifically was often of little relevance in decision-making related to trade activities. This was by virtue of alternate priorities (of farmers and fishermen) or structural conditions that made prices non-negotiable. By discussing a number of these priorities and conditions, we wish to restore some attention to the broader practices of trade that, under some circumstances, have rendered the mobile phone absolutely indispensable according to market actors, but not in the ways most emphasized by both researchers and the press.

(1) INFORMATION ON PRICES IS NOT NECESSARILY SCARCE

Scarcity of information on prices is highly dependent on location - not all rural areas in developing countries experience such drought. In China, for example, the going prices for crops are widely known:

"I know the prices of crops and all those agricultural news from television. Also, there is a government official who comes to the village and tells us, he is from the agricultural office in the town,"

says Mr. Liu, a farmer in his mid-50s who lives in Shandong. In the three villages where the second author carried out fieldwork (one in Hebei, two in Shandong, both provinces in Northern China) information on prices, but also on agricultural techniques, on fertilizers, on diseases and on new crops, comes from sources such as television, radio, newspapers (for those few who read them), traders, neighbors, agricultural extension workers, the head of the village, etc. People find out prices from multiple sources, and then constantly double-check them in the course of casual conversations. Most of this information gathering and sharing is not based on written text, but rather on oral exchanges among people known in person - a neighbor - or for their official role - a trader, an agricultural extension worker. Prices, at least at this level of small commerce, are inextricably embedded within relationships among people.

Mrs. Cai, a middle-aged farmer in the Hebei village, has had a computer for a couple of years, and goes online every day, but mostly for entertainment and to watch television. She says:

"We don't need the computer for (agricultural information). The agricultural extension worker comes to the village for all that we need to know about farming."

Mr. Ding, an older farmer in one of the Shandong villages, has a mobile phone and receives a daily weather forecast SMS. He is aware of the opportunities offered by the Internet, but even more aware that a lot of information that he could find himself online already reaches him through the agricultural extension worker:

"There is an agricultural extension worker, actually there is one in the county and one in the town, so we get the one from the town, he comes here to tell us about fertilizer, or pesticide and all that. So we don't need to find out this information, because he tells us."

The Chinese agricultural extension worker brings not only information, but also 'meta-information' that help farmers place what he says in context. Mr. Ding, echoed by other farmers, points out that he knows the agricultural extension worker personally, therefore he can evaluate the information he receives. It is certainly not the case that it is all good, or impartial, or useful information. But by knowing who the agricultural extension worker is, how he works within the community, what kind of relationship he has with, for example, seed sellers, Mr. Ding knows how to

parse what he says, and understand it in context. All this context is lost when the same information is detached from the information provider (Oreglia, Liu & Zhao 2011).

Fieldwork in Uganda pointed to similar matters of relational context and a concern with information source, but also especially to the material resources necessary to make it possible to act on better information. A focus group with members of a remote fishing village on Lake Kyoga showed a relatively low level of interest in information relative to other needs and priorities. When participants were asked directly about what types of information they desired, they continually turned the discussion back around to assets and facilities that would improve their lives. This started with a problem of translation: there was no word in Luganda that directly translates to 'information' so the word for 'news' was used as the best substitute. For example when asked:

Interviewer: "if you want information [news] on fishing issues, the information you will be interested in, what will it be talking about?"

Fisherman: "For the information [news] I would be interested in is that the government has put in place a good way of fishing, like giving people new fishing nets..."

In other words, the fisherman, in light of regulations enforced by the government against the use of traditional fishing nets (due to overfishing), wanted 'information' that the government would be giving away the legal (and expensive) nets. He did not truly desire information – he knew the rules and how they affected him - but rather he sought more tangible assets.

Adding further nuance to the issue of information in remote, rural communities and its perceived scarcity, the village chairman (also a fisherman) expressed a desire not simply for information, but for "advice." Speaking now of the use of mosquito nets (or lack thereof) in the village to prevent malaria, the chairman responded "you may be having the money [to buy a mosquito net], but if no one has encouraged or advised you to use the mosquito net you may not bother." What he drew attention to with this comment was the question of information *source* and of the quality of the relationship between what he envisioned as a kind of mentoring figure and the village community.

The examples of the Ugandan chairman's desire for 'advice' and the Chinese farmer's reliance on the agricultural extension worker contrast with the impersonal nature of 'information' as it is conceived in scholarship that explores its role as a catalyst for socio-economic development. The lack of a word for 'information' in the Luganda language is a reminder that the general enthusiasm surrounding information as a development salve is promoting a concept to social/cultural settings where it is not, perhaps, as salient.^{iv} In a rather literal sense this points to a kind of atomization and reification of information, which is assumed to be equally valuable and interpretable without a source and independent of relational context. Yet our insights from fieldwork suggest rural agriculturalists see it otherwise.

(2) MARKET PRICES ARE OFTEN IRRELEVANT OR SUBORDINATE TO OTHER FACTORS IN TRADE RELATED DECISION-MAKING

An abstracted view of the role of information in the market removes prices from the trade practices and relationships between trade partners in which they are embedded. Yet such relationships appear to be especially critical at the level of smallhold farmers and fishermen. Within a narrow framing that focuses on the individual transaction, decision-making that does not select for the best price may appear sub-optimal. However, within a larger framing, strategies of long-term planning, and circumstances that modulate levels of tolerance to risk can provide an explanation to seemingly irrational decisions.

Price is often an important factor in decision-making, but it is also one of several variables embedded in specific local conditions. Existing business relationships, trust, attitude towards risk, and institutional rules and policies around the goods traded are all inputs for fishermen and farmers' final decisions on whether to sell or not, whom to sell to, what species to fish and what crops to grow, etc. In particular, among our research participants, two factors took precedence over price in making sales decisions: long-term relationships with trade partners and individual attitudes towards risk.

2.1 Long-term relationships with trade partners

Trust plays an important role in market activities (Humphrey and Schmitz 1998). Among our research participants, it usually derived from personal relationships, rather than institutional frameworks. An absence of strong institutional structures to enforce contracts (which characterizes both Ugandan and Chinese markets at the smallholders level) results in market actors who are more reluctant to trade with strangers and those with whom they have no track record of successful trades (Fafchamps 2004). The risk of a violated contract is simply too great.

In Uganda, as one trader/middleman in the fish export business noted,

“Some other people can lie to you that they will give you cash immediately, you bring the fish but then when you bring it, they disappoint you.”

The significance of relationships was all the more evident on Lake Victoria where fishermen, by and large, took credit from the middlemen who bought up fish and transported it to the factories for export. Given these credit dependencies, fishermen (who had progressed in trade enough to own some assets such as a boat or nets) sold exclusively to the middleman to whom they were indebted, removing the possibility of comparing and making decisions on whom to sell to based on the best price. Moreover, beyond the way credit dependencies removed the possibility of price negotiation, for the lowest level fishermen working exclusively on salary, checking prices could even be a threat to their employment or freedom. Fishermen at this level own no assets and have no say over whom to sell the fish catch to or for how much. One such fisherman who also worked as a porter (another low-level, labor intensive jobs) commented on market prices,

"I leave it to the boss because if am caught he would throw [me] in jail, it would clearly indicate that I clearly want to operate behind his back."

He refers to those fishermen who, once outside the surveillance of their employer, will attempt to sell some portion of a fish catch. Scarcity of supply could also subordinate price. A woman who worked as a smoked fish seller in the fishing village on Lake Victoria in Uganda noted that:

"When the supplier sends the fish he tells the price and you have to pay that price. If you do not he gives the fish to someone else and because we need the business we just pay."

For her, the mobile phone was most critical for capturing supply. It was essential that she maintain her availability so that if her supplier called she could be there immediately to buy his fish before another smoked fish seller did. Characterizing her relationship to her supplier she said,

"I have been his customer for a long time I have been dealing with him for 3 years now... I buy from him at good price, I don't disturb him."

In other words, she makes transactions with her supplier as smooth and seamless as possible and does not even haggle over prices or call other suppliers to check their prices. She offered this as an explanation for why her supplier treated her with preference over other smoked fish sellers.

2.2 Attitude Towards Risk

Among rural agriculturalists, traders, and retailers at the low-income end of the spectrum, income predictability (an expression of their conservative attitude towards risk) often appeared to take precedence over a short-term focus on maximizing profits. This was the case with the smoked fish seller (above) who since separating from her husband seven years prior became her family's sole breadwinner. She was the one upon whom her children (and specifically their education) were totally reliant. She was explicit about the purpose to which her profits were put, as she said,

"I am gaining some money which I use for the children's school fees."

In both sites we have seen varying degrees of willingness to take a risk, and to diverge from the patterns of others (neighbors, etc) in order to realize a gain, often related especially to family composition and stage of life. This was also true among the Chinese subjects, who were mostly middle-aged or elderly. In China, the average age of farmers is increasing (Huang 2012), which often means that farming serves as a combination of income generation and as a sort of social security. Farmers, who do not have any kind of state pension, grow crops that can be both sold and eaten, and their main concern is predictability. If there are emergencies, it is easier to rely on remittances from migrant children or find a casual job nearby, as Mr. Liu says:

“There isn’t a big pressure to get a better income from the land, because almost everybody has income from work outside. I’d say for most families, half of the yearly income is from the land, half from other work... Also, my goal is not to grow my income or business, as long as things remain ok, that’s all I need. The internet is useful for young people who want to improve and grow their business, not for old people like me. My children are all grown up and have good jobs, so I don’t need much and don’t have lots of worries. Until two years ago I also went out to work but now I don’t. There’s no need.”

Prior to any decision-making about prices, both the Chinese farmers and the Ugandan fishermen had an initial decision to make about what crop to plant or what species to fish. These decisions were made in anticipation of price, but often in terms of how stable or predictable the price was likely to ultimately be for their harvest. Besides price fluctuations other factors related to risk entered into this decision. For the fishermen, fishing the variety called Mukene^v (as opposed to the larger Nile Perch and Tilapia fish for export) meant staying closer to shore and facing less exposure and danger (from storms or pirates) out on open water. For the Chinese farmers, planting the same crops as their neighbors was another way of mitigating risk, as other farmers in the village provide a network of support for the individual.^{vi} They share their knowledge of farming – sometimes directly by giving suggestions, sometimes indirectly by starting to do a specific task such as using fertilizer in their field and thereby communicating to the others that it might be time to do that work; they share risks, so if something happens to a crop, it’s usually a common problem and perhaps someone will come up with a solution. It is important to note that this is not in any way a communal form of agriculture as in the collective farming of the pre-1980s reforms era, where the land was owned by the village, and each village had to grow crops according to the central government’s planning, but rather a practical solution to distributing risks. The network of support represented by neighbors growing the same crop and potentially experiencing the same issues disappears when a farmer decides to grow an unusual crop, and therefore doesn’t have anyone to consult on timing, or if things go wrong. The ‘infrastructure’ necessary to make the challenge of growing a potentially lucrative crop a reasonable risk rather than a potentially devastating enterprise was entirely absent, and knowing that the crop would fetch a better price than what was ordinarily grown did not make up for this absence. For farmers who depend entirely on their crop for their food and income, the risk could potentially be ruinous, and one disastrous year would be enough to make them desist from experimenting with riskier crops.

If the selling/buying behavior of farmer Liu in China and the smoked fish seller in Uganda is seen as one discrete decision point, it might seem illogical, irrational, or irresponsible. Seen in a bigger context of life events and opportunities that unveil in the course of a longer period, and that are shaped by past experience and current conditions of both the individual and the community, then they appear not only as logical, but also as inevitable from the perspective of the life-trajectory of the individuals involved.

(3) IMPROVEMENTS IN MARKET EFFICIENCY REALIZED BY THE MOBILE PHONE MAY NOT STEM FROM THE BETTER CIRCULATION OF MARKET PRICES

Market efficiency gains, as Jensen compellingly showed in his study of fishermen in Kerala, can potentially follow from better spatial arbitrage. In the practice of spatial arbitrage market actors call around to multiple locations and compare prices selling their goods wherever they get the best price. They may travel to more distant markets that are undersupplied when necessary. The consequence is that prices will stabilize and differences in price will logically follow only from transport costs. However, this does not mean that all gains to market efficiency following from the mobile phone are the result of such a practice.

Wholly apart from questions of market price, a constant refrain among rural mobile phone users is how, by using the mobile phone, they save on wasted trips, as also noted in Overa (2005). The issue of 'wasted trips' though it certainly has to do with inconveniences and discomforts experienced by market actors, also ultimately has to do with market efficiency. The information that pertains to this work of avoiding wasted trips (and waste in general) was not specifically market prices. For example, a relatively affluent fisherman with 8 wives, noted the value of his mobile phone for calling and requesting ice (key to preserving fish). He would call any of his contacts at the landing site and have them send out ice to him on the next boat. Ice, storm information, and equipment failure were all unpredictable factors. The trader first mentioned above, who bought fish for export spoke of a particular recent incident where just such a series of factors were in play (engine trouble, a storm) and a shipment of fish was saved from being dumped by the use of the mobile phone.

"After the coming of the phone, I remember one time the engine failed when we were supposed to arrive here at 4:00pm and if we didn't get in contact with people here, the truck would leave us. So we had to inform them about our problem and assure them that we were coming and we arrive at almost 10:00am because of engine failure and the storm. But because we had informed them, they were here waiting for us. So the phone helped us so much."

We can characterize this as coordination work, specifically work to synchronize buyer and sellers (or fishermen and supplies) in time and space. In Uganda, the information being passed around had to do with quantities of fish, availability of supplies (ice, fuel), location of vehicles and people, estimated time of arrival, sufficiency of cash for payments, etc. Along the way reputational information was not necessarily explicitly communicated, but nonetheless acquired through the process of arranging these transactions and whether state communicated by phone later matched up to the in-person exchange. This is reflected in the fish export trader's comment (as quoted above), "people can lie to you that they will give you cash immediately, you bring the fish but then when you bring it, they disappoint you." The converse situation bolsters the reputation of the one who came reliably with cash as they had promised.

Similarly, the head of the village near where Mr. Liu lived had a contact at a wheat mill, and would call him at harvest time to negotiate the sale of wheat

directly, on behalf of most of the villagers. The price was usually slightly higher than what traders offered, and farmers trusted the head of the village to negotiate a good deal for everybody, because of his personal relationship with the mill buyer. The phone facilitated a relationship and the practical coordination aspects of it, both of which had been in place before the arrival of any kind of telephony.

The more direct evidence of these reported practices suggest other mechanisms that may be responsible for improvements in market efficiency. These improvements result not from market prices, but other kinds of information, especially what is imparted in the coordination work among trusted parties in order to avoid loss, waste, and delay.

(4) OBTAINING MARKET PRICES IS OFTEN NOT THE MOST VALUED APPLICATION OF THE MOBILE PHONE IN TRADE

Besides coordination work, fishermen found that the mobile phone was useful – indeed, in some cases essential – for its most basic functionality: connecting two individuals across sometimes vast distances for synchronous speech-based communication. The phone can help to establish and maintain one’s reputation, as briefly noted above. Phone calls picked up immediately or made to communicate the status of a shipment contribute to the reputation of the market actor just as do successful face-to-face transactions. For some, this was considered absolutely critical to being able to participate in trade at all, as the smoked fish seller notes: *“If you do not have a phone, you can’t get these kinds of jobs.”* Here we are still referring to the mobile phones capacity to distribute information (about the state of a boat’s supply of ice, for example) in speaking about coordination work, yet this is an incomplete characterization of this use of the phone. Such phone calls did not just transfer information, but also communicated requests or commands – to ‘send ice’ or to ‘meet the boat at a particular time and place’ or commitments such as, ‘I will come with cash.’ These phone calls were speech acts that had some force. Looking at communicated speech in this way, it is helpful to distinguish between locutionary and illocutionary acts of speech. The former refers to what the speaker says specifically, the latter to the force of what is said and the intended effect on the listener, to drive the listener to specific actions (Austin 1960). Information communicated about price also entailed an indication (if not a firm commitment) that the buying party, in imparting a price, would be willing to buy at that price.

Secondly, uses of the mobile phone also differed quite substantially between roles in the fish supply chain. For frontline fishermen in Uganda who worked for salaries (and thus were not part of price negotiations), by far the most critical use of the phone was to seek rescue when an engine died, a storm struck, or the boat was attacked by pirates, as other studies have also found (Abraham 2007; Sreekumar 2011). For middlemen in the fish supply chain, the phone could be useful as a tool for doing surveillance and monitoring at a distance. The fish export trader, who was concerned that the fishermen who were indebted to him would sell some portion of the catch surreptitiously, used his widely dispersed social network, a product of a lifetime living and working in the area, to keep track of his debtors. The phone was critical to this as he noted, *“when you come to me, I first find out who you are, your family and about your work so even if he [the fisherman] got lost, I would locate him.”*

To locate this debtor he called around to other villages to find fishermen who had disappeared and to get reports of whether fish had been sold without his knowledge.

This is not to say that 'pure' information sources are never valuable. In rural China, by far the most successful use of mobile phones in farming has been the weather forecast report delivered by SMS every day. The subscription costs about RMB3 per month (\$0.42), and many farmers subscribed to it, even those who had a hard time reading the screen or finding the message itself. The forecast helps decrease short-term uncertainty, and augments existing sources. As, again, Mr. Liu summarizes:

"First I watch the national weather report on television; then I watch the local one; then I compare them with the weather forecast I get on my mobile. Then I analyze this information and come up with my forecast, and it's 70% reliable."

The weather forecast is something immediately actionable, and it fits Mr. Liu's existing routine to assess the weather: listening to news about it from multiple sources. It is also something that complements existing sources of information, which are not specific enough to his area, nor accurate enough.

This fourth and final 'myth' about market price information is a reminder of that the mobile phone, in practice, is understood and employed as far more than a platform for information access. When information was sought, it covered a range of topics that went well beyond market prices to include status updates about shipments and transactions in process, information about trade partners that might reshape reputation assessments, and weather predictions. The phone was a platform for relational work, for communication, for sparking action. On the whole, the information exchanged was inseparably intertwined with this work.

Conclusion

The two field sites and populations compared in this article contribute similar insights to our critique of the 'myth of market price information' and to an alternative understanding of the role of market prices and information delivery via mobile phone. They are also, however, organized in different ways, in terms of their trade practices, and in their livelihood strategies. In China, the sharing of risk was a key consideration in deciding what to plant and in selling the resulting crops. Farmers generally did not seek a competitive edge by differentiating from other farmers, but rather followed along with their rural neighbors as a way of buffeting themselves against the vagaries of weather, crop pests, and the global economy. In Uganda, the nature of fishing entailed travel onto the lake and away from the landing site for a few days at a time. This plus the perishability of this commodity yielded a special emphasis on the need for efficient coordination across time and space and between different roles in the fishing industry in order to supply ice and fuel, seek rescue, and predict arrival times among other forms of contingency handling.

Our purpose was to illustrate alternate logics and strategies in agricultural work. We drew a distinction between models of the optimizing market behavior of

market actors and the strategies undertaken by farmers and fishermen at the lowest income levels. In Uganda these were the fishermen working on salary, concerned primarily with safety and survival (against storms, pirates, and angry bosses) and making use of the mobile phone toward that end. In China, the elderly farmers living in a state of quasi-retirement who sought a kind a subsistence income supplemented when necessary through family networks that extended to other non-agricultural sources of income. By considering the alternate reasoning of these market actors as a challenge to the “myth of market price information” our point was not to question the existence of profit maximizing behavior, but rather to challenge the notion that this is necessarily the most reasonable or somehow automatic strategy among agriculturalists regardless of their life circumstances. In doing so we have also pointed to the broader range of ways a phone may be found indispensable.

Distinguishing between low- and higher-income agriculturalists is necessary in order to address the issue of equality in access to ICT and services delivered through it. Our findings indicate that mobile-based applications and services are not necessarily of direct benefit to all segments of the populations we study: the poorest and most marginal are often the most difficult to support with ICTs. The mobile phone has diffused remarkably into rural and remote regions and into the possession of individuals in diverse socio-economic circumstances around the world, but efforts to build upon the serendipitous accessibility of the phone (that supports any spoken language so long as caller and receiver both speak it) may subvert this accessibility, for example, when replacing voice-based with text-based modes of communication (as SMS market information services do) that require some amount of both technical and language literacy.

Our analysis has pointed to the way concepts that reflect chiefly disciplinary preoccupations circulate, are simplified (as boundary objects), and amplified within diverse and cross-disciplinary communities, such as that of ICTD. We have also compared economic approaches to those of computer scientists and system-builders and then inserted the divergent approach of our own epistemic culture. For economics, markets are the main object of study, and prices one of the crucial parameters worked in their models. Therefore, economics approaches an issue such as agriculture in a developing country from its 'natural' perspective, that of the market and of prices. ICTD, on the other hand, is a cross-disciplinary community whose object of study spans very different fields (information and communication technologies that could range from devices, such as a radio, to applications, such as the internet on a phone or on a computer; and development, from both an economic and a social perspective), and therefore mixes the different disciplinary perspectives and parameters of its diverse members. The field of agriculture is approached using concepts borrowed from disciplines such as economics (markets and prices), agricultural sciences (when looking at ways to use ICT to increase productivity or disseminate information about diseases or fertilizers), and engineering (when solving practical problems related to infrastructure, connectivity, bandwidth, etc). As the first wave of mobile- and web-based market information systems begins to be assessed, there seems to be a consensus that prices alone are not sufficient, and that a 'prices plus' approach is the preferable solution, where the plus consists of

other types of localized information, see for example a recent Mobile for Development webinar (GSMA 2012). In focusing on the practices and priorities expressed by small market operators such as fishermen in Uganda and smallhold farmers in China, we suggest a starting point to incorporate different realities into a new generation of market information services and other types of mobile applications.

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ⁱ An effort by our summer intern Luisa Beck to locate as many of these market-related services as could be found turned up 216 total projects 72 of which provided market price information. The majority (50) offer market information via SMS with most of these (34) offering such information only in text format. See <http://markets.ischool.berkeley.edu/projects/>. The most well-known and widely scaled services in this space are a mixture of aid agency and private sector efforts and include Esoko (formerly TradeNet), Reuters Market Light, Mistowa (a project of USAID), and Nokia Life Tools.

ⁱⁱ Fafchamps and Minten 2012 find very low adoption rates by farmers of India's Reuters Market Light SMS-based market price system even though it was provided to study participants at no charge. They also found no statistically significant evidence that use of the system improved the prices farmers got for their crops. Camacho and Conover 2011 in their study of SMS market price information use by Colombian farmers, find no significant increase in sales price or overall revenue. All of these studies use a randomized controlled trial (in line with the design of Jensen's study which was described as a natural experiment) to arrive at their findings. Aker and Fafchamps (2010) in a recent working paper look not at SMS market information systems, but similarly find evidence negating gains in price to front line, small-scale farmers who use mobile phones.

ⁱⁱⁱ See also a recent study in Peru that likewise argued for poverty-alleviating benefits for households that had a mobile phone as well as households that did not (Beuermann et al 2012).

^{iv} The contemporary notion of information goes back to the mathematical developments of "information theory" and the work of mathematician Claude Shannon. Frank Webster points to efforts to quantify growth in the amount of information as a reflection of the way definitions of information have come to dispense with information as containing semantic content. It is understood instead "as a physical element as much as is energy or matter." (Webster 2006).

^v Known as minnows in English, (latin name *Rastrineobola*) (Pringle 2005).

vi The majority of farmers in the areas where the second author did fieldwork grew the same crops: wheat and corn, typically planted one after the other, followed by peanuts, sweet potatoes, and some cotton. This is aligned with province-wide statistics on crops, although there is more variety in other districts. Shandong is renowned for its apples, grapes, and cherries, as well as its vegetables, but these tend to be cultivated by bigger commercial entities and be more integrated in wider markets [Vassilos, 2008]. Wheat and corn are the traditional crops of Northeast China. Their prices do not fluctuate much since 2006, when the government established a “minimum guarantee price” policy for wheat. This means that when the market price is lower than the minimum price fixed by the government, SINOGRain (the China Grain Reserve Corporation that is the implementation body for this policy) purchases farmers’ grain at the minimum guaranteed price (Li et al 2011:97-98) This made crops like wheat very attractive for farmers who preferred to avoid or at least to share risks: they planted what their neighbors were planting, they watered their fields, used pesticide or fertilizers, and started works like seeding and harvesting at the same time as the rest of the village. Sometimes timing had to be coordinated because of external factors. For example the machines that do the work of harvesting wheat and maize come to the village at the same time, and everybody rents them around the same days and pays the same price.