

Research Article

Mobile Phones and Economic Development: Evidence From the Fishing Industry in India

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Abstract

There is considerable speculation about the correlation between investments in telecommunications and economic development. Yet, there has been very little research on whether there is a connection between information and communication technologies (ICTs) and economic growth, and if indeed a connection can be established, how it works. Vast populations in developing countries live in rural areas and are subject to the vagaries of their highly inefficient markets. Mobile phones, by virtue of their role as carriers and conduits of information, ought to lessen the information asymmetries in markets, thereby making rural and undeveloped markets more efficient. This article tests this assumption using a case-study from India, where the fishing community in the southwestern state of Kerala has adopted mobile phones in large numbers.

Using mobile phones at sea, fishermen are able to respond quickly to market demand and prevent unnecessary wastage of catch—fish being a highly perishable commodity—a common occurrence before the adoption of phones. At the marketing end, mobile phones help coordinate supply and demand, and merchants and transporters are able to take advantage of the free flow of price information by catering to demand in undersupplied markets. There is also far less wastage of time and resources in all segments of the fishing community. Fishermen spend less time idling on shore and at sea, whereas owners and agents go to the landing centers only when they receive information (via mobile phones) that their boats are about to dock. We find that with the widespread use of mobile phones, markets become more efficient as risk and uncertainty are reduced. There is greater market integration; there are gains in productivity and in the Marshallian surplus (sum of consumer and producer surplus); and price dispersion and price fluctuations are reduced. The potential efficiencies are, however, subject to easy access to capital, especially at the production end of the supply chain, without which the market remains less efficient than it could be. Finally, the quality of life of the fishermen improves as they feel less isolated and less at risk in emergencies.

Introduction

Information is power. Nowhere is this aphorism truer than in developing countries. Vast populations in these countries live in rural areas¹ and are subject to the vagaries of their highly inefficient and information-asymmetric markets, marked in particular by the tremendous uncertainty

1. In India's case, almost 65–70% live in rural areas.

and risk of doing business. As Geertz (1978) wrote of isolated rural villages, “information is poor, scarce, maldistributed, inefficiently communicated and intensely valued. [. . .] The level of ignorance about everything from product quality and going prices to market possibilities and production costs is very high.”

A smoothly functioning market requires the following elements to be in place: the smooth flow of information, property rights, trust, competitive markets and that side effects on third parties are curtailed (McMillan, 2002). This paper is devoted to examining the information inefficiencies inherent in rural markets and ways to reduce them. In particular, it examines the use of mobile phones by fishermen, and the effect this has had on fishing industry markets.

Hypothesis

My hypothesis is that information and communication technologies (ICTs), by virtue of being carriers and conduits of information, play a role in correcting large-scale information asymmetries and inefficiencies that exist in developing countries, especially in rural and unorganized markets. Correcting these asymmetries makes these markets more efficient and raises productivity to some extent.

I used a case study from India on the adoption of mobile phones by the fishing community—among the poorest of the poor—to test my hypothesis. The case study includes an exhaustive literature review, secondary data, and interviews with more than 50 experts to set the stage for the field work and data analysis. The field work was conducted at 12 locations in the southwestern state of Kerala, over a 200-kilometer radius. It included focus groups and a purposive quota sample survey, which was conducted using a questionnaire of 20–25 questions, depending on fishing industry category being sampled. A total of 172 individuals, from across the fishing industry, were interviewed for the survey. Another 15 individuals were interviewed for a pilot study that preceded the final survey.

Historical Precedents

Mobile phones are not the first communications technology to have transformed markets. The most

relevant historical parallel is with the introduction of the telegraph into the agrarian economy of nineteenth-century United States. According to Garbade and Silber (1978), delay in communicating price information between market centers was one of the important causes of intermarket price differentials. They argue that the telegraph and trans-Atlantic cable led to a significant and rapid narrowing of price differentials between markets.

Entrepreneurs on the lookout for new markets hastened market integration, helped greatly by the railroad and the telegraph, which, in turn, transformed business operations entirely (Du Boff, 1980). At a more fundamental level, Du Boff (1980) found that (a) the telegraph lowered information and transaction costs, freeing resources for alternative uses, and (b) instant communication improved the efficiency of markets, above all by increasing information about prices. He added that the rise of the telegraph “allowed businessmen to obtain immediate and extremely accurate information on market prices and quantities and to reduce market uncertainties of all kinds. Such price data are essential when producers have several potential markets, or suppliers, at their disposal.” The rise of speedy arbitrage operations and new information institutions “ensured that the price differentials among markets would narrow to the cost of transportation and transactions between places.”

Carey (1988) suggests that the telegraph played a large part in ending arbitrage across distances and, by shifting arbitrage to the temporal dimension, led to the birth of the futures markets. Supporting Carey’s contention, John (2000) points to the birth of the modern mercantile exchanges in Chicago and elsewhere to coordinate and facilitate trade in agricultural commodities. Standage (1998) makes a point of great relevance to this paper: “In Britain, for example, fishermen and fish traders used [the telegraph] to notify markets of catches and to determine market prices—something that was particularly important given the perishable nature of the goods.”

Prices as Information Aggregators

In his seminal article “The Use of Knowledge in Society,” Hayek (1945) writes that “in a system where the knowledge of the relevant facts is dispersed

among many people, prices can act to coordinate the separate actions of different people in the same way as subjective values help the individual to coordinate the parts of his plan." Prices and market signals are the key instruments that facilitate the coordination issue involved in the allocation of resources to their best possible uses. Prices transmit all the information that participants require to make effective decisions on both the production and consumption sides (Eggleston, Jensen, & Zeckhauser, 2002). According to McMillan (2002), "In well-functioning markets, prices serve to aggregate the information that is dispersed among the market participants. With prices serving as a feedback mechanism, the market system coordinates the actions of millions." Jacobides (2001) makes a similar argument: the market's key distinguishing feature lies in its ability to achieve coordination through the decentralized information prices confer and the resulting desirable properties of the price discovery mechanism (in free and well-behaved markets).

Asymmetric Information and Transaction Costs

Transaction costs or market frictions (time, effort and money) are kept in check in well-designed markets. When the price mechanism doesn't work, however, large parts of a market may remain ignorant of crucial market information; the cost of acquiring information will be higher; and time to react to new information will be slower. Stiglitz (1989) also showed that imperfect information impeded market entry. In extreme cases, markets can cease to exist in the absence of reliable information. Anyone with privileged access to information will be in a powerful position—an advantage they could not as readily exploit if prices and the information they aggregate were well known.

Market Inefficiencies in Developing Countries

The problem in developing countries is not that markets are absent but that they are functioning badly. One of the key features of these markets is the deviation from the economic principle that prices of homogeneous goods sold at different locations should be equal, net of transportation costs (Eggleston, Jensen, & Zeckhauser, 2002). Stigler (1961) put it

succinctly—"Price dispersion is a manifestation—and, indeed, it is the measure—of ignorance in the market." Stigler adds, "The greater the instability of supply and/or demand conditions, the greater the dispersion of prices will be."

McMillan (2002) tackles the issue of the free flow of information through markets: "Information is the lifeblood of markets. A market works badly if information does not flow through it. Rarely does information flow absolutely freely, but well-functioning markets have various mechanisms to aid its movement." Most developing countries have poorly functioning markets characterized by poor internal flows of information. Such an uneven distribution of information hinders negotiations and limits what can be contracted.

A study of maize prizes in Ghana over a 13-year period found that the estimated time required to fully transmit a price shock from the central markets to two outlying markets, Makola and Bolgatanga, was about four months (Badiane and Shively, 1998). Antle (1983) showed that poor ICT infrastructure affected productivity in the agriculture sector. Coyle (2005) suggests that "the improved flow of information reduces monopsony power in agricultural markets—especially non-commodity markets such as perishable fruits, where prices were not already published in newspapers."

The Role of ICTs in Economic Development

ICTs can help in improving information flows, reducing search costs and generally contributing to market efficiency. Eggleston, Jensen, and Zeckhauser (2002) show that the addition of basic telephony services in rural China reduces price dispersion and the purchase prices of various commodities. Hirschmann (1967) noticed that a credit market for coffee had developed in Ethiopia after the installation of a long-distance telephone network. A set of studies of the Grameen phone project in Bangladesh suggests that nearly half of all telephone calls made using the Grameen network were for economic purposes such as discussing market prices, employment opportunities and remittances (Richardson, Ramirez, & Haq, 2000; Bayes, Braun, & Akhter, 1999).

Hardy (1980) attempted to examine the effect of the telephone on economic development. He found

that GDP is higher and growth faster in countries with advanced telecommunication networks, though there is a clear problem of reverse causality.² Norton (1992) tried to control for reverse causality and arrived at the same conclusion as Hardy. In the early 1990s, Alleman et al. (2002) posited that inadequate ICT infrastructure would hamper economic growth. Saunders, Warford, and Wellenius (1994) found that investments in telecommunications generated internal rates of return of about 20 percent. Bedi (1999) suggested that a minimum threshold of ICT density was required in order for these technologies to exert an influence on growth. Furthermore, he added that “firm-level studies indicated that there might be substantial time lags between ICT investments and their positive effects.”

Madden and Savage (1998) analyzed the mechanism by which ICTs might have positive effects on economic development. They suggested that information flows play a critical role in the functioning of markets and that telecommunications are a powerful tool of information transfer. Building on their own previous work, Röller and Waverman’s (2001) analysis of OECD countries revealed that about one-third of economic growth could be attributed to investments in ICTs. The network externalities³ associated with ICTs implied that positive growth effects might be subject to achieving a critical mass of ICT infrastructure.⁴

In a recent study, Waverman, Meschi, and Fuss (2005) comprehensively examined the impact of mobile telephony on economic growth in Africa. Using data from 92 high-income and low-income countries from 1980 to 2003, they tested whether the introduction and rollout of mobile phones added to growth. They found that “mobile telephony has a positive and significant impact on economic growth, and this impact may be twice as large in developing countries compared to developed countries.” Looking at the specific examples of the Philippines and Indonesia, they find that “all else being equal, the Philippines (a penetration rate of 27% in 2003) might enjoy annual average per capita income

growth of as much as 1% higher than Indonesia (a penetration rate of 8.7% in 2003) owing solely to the greater diffusion of mobile telephones, were this gap in mobile penetration to be sustained for some time. A developing country which had an average of 10 more mobile phones per 100 population between 1996 and 2003 would have enjoyed per capita GDP growth that was 0.59 percent higher than an otherwise identical country.” They also investigated demand elasticities in developing countries and found elasticities to be significantly greater than 1. “That is, demand increases much more than in proportion to either increases in income or reductions in price.”

Telecommunications in India

Despite a long history of telecommunications in India, the sector was never considered important enough for serious investment because it was considered by policy makers to be a “luxury” that the vast majority of Indians had no use for. Only in the last six years—since the implementation of serious reform—has the sector been unshackled of its regulatory and policy constraints, leading to telecoms becoming the fastest growing infrastructure sector in the country. There are now in excess of 200 million phones (landlines and mobiles combined) in India, making it the second-largest network in the developing world behind China (Figure 1). The main driver for this rapid growth has been the growth of the mobile phone industry. From fewer than a million subscribers less than 8 years ago, the market has grown to about 156 million subscribers today. Despite these numbers, the teledensity remains an unhealthy 11 telephone lines per 100 people, which reveals the scope for growth.

The Fishing Supply Chain

Fresh fish is a highly perishable commodity which, in principle, requires the shortest possible supply chain with as little involvement of intermediaries as possible (Figure 2). In reality, the catch goes through a

2. Did the faster growth lead to increased uptake of telecommunications networks, or did the increased uptake of telecommunications networks lead to higher growth?

3. Network externalities refer to the effect that certain products increase in value as more people use them. For example, the usefulness of a telephone or of the Internet increases as more people join the network.

4. Across Organization for Economic Co-operation and Development (OECD) countries, critical mass was taken to be 40% penetration of telephony, or close to universal service, assuming the average OECD household is 2–2.5 persons.

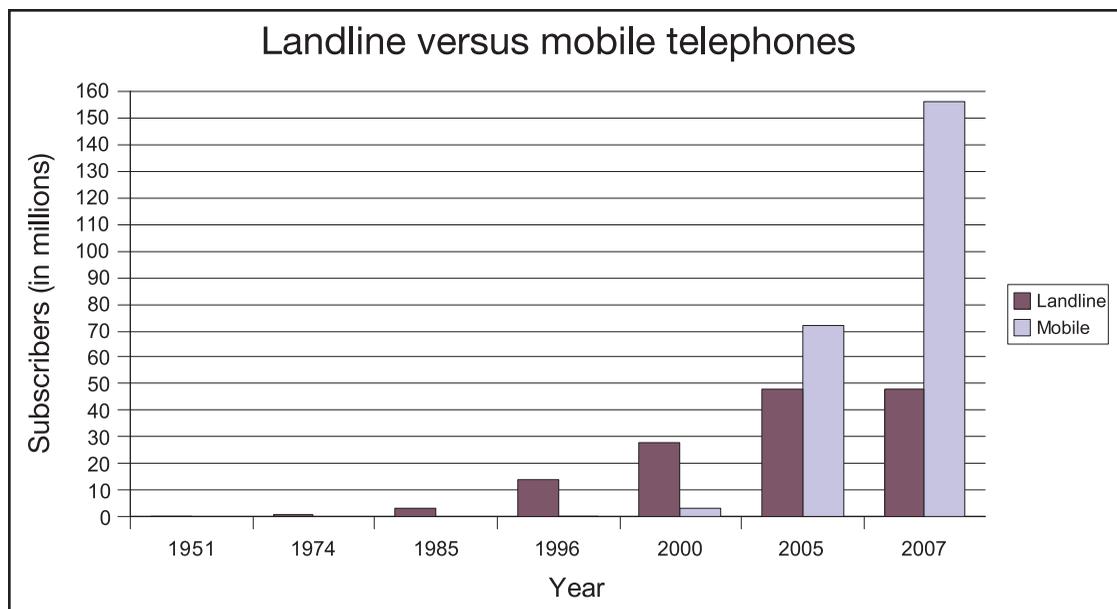


Figure 1. Telephones in India (number of mobile and landline subscribers).

complex distribution chain from the producer/ fishermen to the end consumer.⁵ The owners of the boats hire fishermen to man their boats. In some cases, the fishermen or a fishermen's co-operative could themselves be the owners. In most of the cases, the boat also has an investment from the commission agent,⁶ who thereby ensures control over the sale of the catch. On landing the catch, the commission agents auction the fish to both retail and wholesale merchants, who then sell the fish to consumers either directly, in the case of retail merchants, or through other retail merchants, in the case of wholesale merchants. After the sale is concluded, the agents then pay the owners after subtracting between 5–10% of the total value as their commission. After paying for the variable costs of the trip, the owners then split the remainder among the fishermen. A stylized representation of the supply chain is expressed in Figure 2.

Analysis of the Data

According to the data collected during the survey, 80% of the total number of respondents perceived mobile phones to be useful. What's more, every segment of the fishing population perceived their usefulness, though a larger proportion of merchants and transporters—the greatest beneficiaries of the introduction of mobile phones—did so. This conclusion is supported by other data: estimates of the total number of subscribers among the fishing community in Kerala range from 80,000 to 100,000.⁷ Given that mobile phone adoption is taking place without any specific subsidies that target the fishing community, we can assume it is being driven by the benefit derived from using them.

The benefit derived can also be observed in responses to a couple of other questions. Eighty-two of the 172 respondents said they would not stop using mobile phones even if the prices/tariffs went up. Given that there were a large number of no-

5. The description of the supply chain here is very brief for want of space. This is the simplest possible description of the chain. In reality, the chain is a lot more complex and involves many more stages.

6. Known variably as an auction agent or middleman.

7. It is impossible to get an exact number here because new subscribers are not asked to list profession when they sign up for mobile phone service. They list that information voluntarily. The subscribers numbers are therefore based on conversations with executives from the cell phone companies who are most likely to know.

responses to this question, 82 respondents represents a fairly substantial number of users with relatively inelastic demand. Specific comparisons made by respondents (like comparing communications to food) offer further evidence of this inelasticity.⁸ Even respondents who claimed mobiles were detrimental to business refused to give them up terming them “indispensable for business.”

Price Dispersion and Fluctuation

According to the “law of one price,” homogeneous goods sold at two separate locations must be sold at the same price, net of transportation costs. A longitudinal comparison of prices of certain specific species of fish across different markets before and after the adoption of mobile phones is the ideal way to detect reduced price dispersion. Unfortunately, getting data to conduct a longitudinal price study turned out to be impossible. Though getting market data for the present is relatively easy, it was impossible to find any reliable market data from before 1997, when mobile phones were first introduced. The market players avoid keeping any formal record of transactions for tax and other reasons.⁹

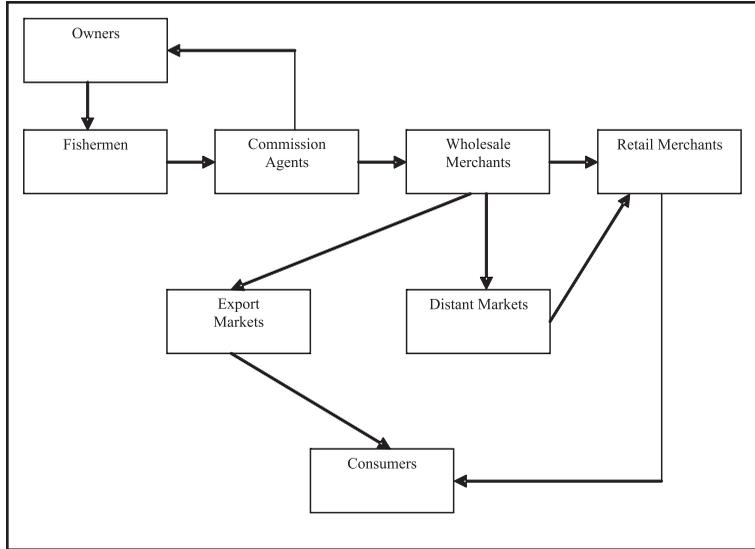


Figure 2. The fishing supply chain.

In the survey however, the three groups within the fishing community most affected by price volatility and price dispersion (agents, merchants, and transporters) overwhelmingly agreed that the introduction of mobile phones had lowered both (Table 1). According to more than three-quarters of the respondents, price dispersion had dropped across markets and so had intraday price fluctuations (Table 2). Informal records maintained by some merchants and agents provided some specific evidence to support this contention.

Another feature of the market before the intro-

Table 1. Price Fluctuations across Markets

	Price Fluctuations across Markets Have Decreased?	
	Yes (%)	No (%)
Agents	81	19
Merchants	93	7
Transporters	100	—

Table 2. Intraday Price Fluctuations

	Intraday Price Fluctuations Have Decreased?	
	Yes (%)	No (%)
Agents	83	17
Merchants	92	8
Transporters	89	11

8. Most people who were asked this question prior to the survey were very uncomfortable with answering, since they automatically assumed that I was a front for the mobile phone companies. In their perception, any honest information they provided regarding their sensitivities to price increases would be detrimental to them. The phone company could potentially use this information to increase tariffs.

9. Besides facing tax problems, a lot of them would lose the subsidies they utilize currently if the transactions revealed a higher income than was being reported.

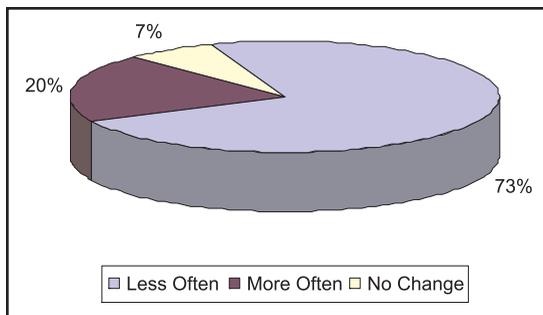


Figure 3. *Glut in one market and scarcity in another happens (merchants and transporters).*

duction of mobile phones were occasions on which there would be a glut of fish in some markets while other markets experienced acute scarcity (Figure 3). This meant that prices would be unnaturally low in some markets and unnaturally high in others because of the mismatch between supply and demand. When they were asked whether the introduction of mobile phones had lowered the possibility of this mismatch occurring, close to three-quarters of the respondents replied affirmatively.

To further examine the possibility of increased market integration, merchants and transporters were asked about their ability to sell in markets outside the local area of operation following the introduction of phones. Once again, large majorities of respondents said they were now able to do so. They also said they could now tap into a much wider market than before. The data showed merchants, owners, and agents making a large chunk of their business-related calls outside their local calling areas, which can be interpreted as a sign that they are monitoring prices at distant markets, providing further evidence of greater market integration. The telecom firms have helped the process of market integration by including the nearest big fishing centers outside Kerala within the local network.¹⁰ This makes it less expensive for merchants to call these markets because they pay only local call rates, not long distance.

Market integration and the free flow of information about supply of and demand for fish remove

inefficiencies and lead to consumer and producer surpluses. Markets will not experience scarcity in the supply of fish for long as merchants and transporters, who monitor prices across markets, are alerted to higher prices prevalent in these markets. They will then meet the demand by routing shipments there, lowering prices for consumers and bringing higher prices for producers.

Practically every merchant, large or small, is now affected by the mobile phone. As one of the respondents in the survey put it, "Mobiles make the markets now." The wholesale merchant who buys fish at the harbor is constantly in touch with retail merchants who know local consumer demand well. He buys if and only if he knows with certainty that the retail merchant will buy the fish from him, while the retailer bases his buying decisions on his intimate knowledge of local consumers and the selling price of fish in the landing center. He will commit to buying from the wholesaler only if the price on offer, after accounting for transport costs and wholesale margins, is equal to or less than the price he knows his consumers will pay.¹¹ The wholesaler is, therefore, not caught in a situation where he buys at a high price and is unable to sell in the retail market as used to happen in the days when he could not monitor demand at the retailer's end. The ability to monitor demand across markets is also of great benefit to bulk buyers such as export houses. Their agents and transporters, armed with mobile phones, are now able procure fish supplies in bulk at the lowest possible rates after making the requisite cost-benefit calculations.

There is a possible downside that, though not widely reported, was nevertheless observed a couple of times during the course of this research. Via mobile phones, news of scarcity and higher prices travels to all merchants and this could result in supply overshooting, where several merchants attracted by high prices all show up in the same market, leading to oversupply and a consequent decline in prices. This is a pretty rare occurrence though, because news of oversupply tends to filter out (again via mobile phones) quickly enough to avoid carnage.

10. These centers include Nagercoil, Tuticorin, Kanyakumari, Coimbatore and so on. The national carriers have plans of making it even cheaper by introducing a flat rate call rate irrespective of distance to the dialed number.

11. At the same time, coordination with other retailers allows him to meet demand from consumers with inelastic demand for fish.

Less Wastage of Time and Resources

The survey also demonstrates that wastage of time and resources has dropped across the fishing sector. Sizable numbers of fishermen and owners agreed that the search costs involved in looking for fish had come down since the advent of mobile phones. This reduced wastage of resources in two ways:

- By reducing the time spent out at sea searching for fish. Other boats in the fishing unit would send out alerts on the mobile phones if large shoals were found. More than 94% of owners and fishermen had used mobile phones to alert other boats to the presence of shoals of fish at some time or the other.
- By reducing the number of fishermen who had to spend time idling on shore. News of large shoals could be easily communicated and the idle resources put to use at once.

The reduced wastage has an immediate impact in terms of fuel costs. Most people in the community point to rapidly increasing fuel costs as one of the main reasons why the sector is seen to be increasingly unprofitable. Under the circumstances, any time saved is worth a lot of money. Not surprisingly, more than two-thirds of owners, who normally foot the fuel bills, noticed that the time spent out at sea looking for fish had decreased. Idle fishermen, who could be alerted to the presence of shoals, also benefited greatly since any income generated from fishing would be an improvement over idling and earning nothing at all.

There was a time when the inability to convey market prices between the owners and the fishermen would lead to large losses. By the time the fish came in, the owners and the fishermen would realize that the price was so low that the catch would either be dumped or sold as fertilizer for crops. The ability to convey real-time price data to the fishermen may even help the cause of sustainability, according to some owners, because the fishing units only catch according to demand and price rather than make catches at random and then hope for the best.

The exploratory research suggested that the use of mobile phones also allows the boats to remain out at sea much longer than before. Earlier, the boats had limited supplies¹² and would have to re-

turn to port when the supplies ran out. Similarly, the boats would leave a large shoal once storage was full and return later to continue fishing. Today, the boats call in smaller carrier vessels that can both ferry supplies and take the catch to the landing center while the main boat continues to fish. This enables fishermen to continue fishing when the return to effort is the highest.

In the survey, however, there was no real indication that the fishermen could now fish for longer. However, almost 50% of the sample did not respond at all, and this nonresponse rate may well have skewed the overall result. Several respondents also indicated that they are insensitive to small changes in time spent out at sea, changes that owners are far more sensitive to, as the survey response demonstrated.

In principle, one of the best uses of the phone for fishermen should be that they can call the landing centers to find where the highest prices for their catch are and to subsequently land there. About two-thirds of the respondents said they had landed in markets with the highest prices at some point of time or the other, but few of them did so regularly. The reason this doesn't happen as often as expected has to do with the role of the agent/middleman. As described above, he invests money in the boat and in the variable costs of fishing expeditions on the condition that he gets to sell the fish at the auction when the catch is landed. His income is guaranteed by a previously agreed upon commission rate in lieu of interest on his investment in the boat. If the boat lands at a market where he or agents he works with do not have a selling presence, he cannot charge his commission.

Given his monopsony market power due to his position as a money lender, he can force the boat to land in markets where he can extract the highest commission, rather than at markets with the highest prices. This credit linkage between the producer and the middleman explains why the data show relatively few fishermen taking advantage of what seems like an obvious benefit of using mobile phones. This diminishes the potential increase in market efficiency. Given the chokehold of the middlemen over the credit market, it is not surprising their commission/interest rates have not come down as expected either. However, the power the middle-

12. These supplies include food and fuel.

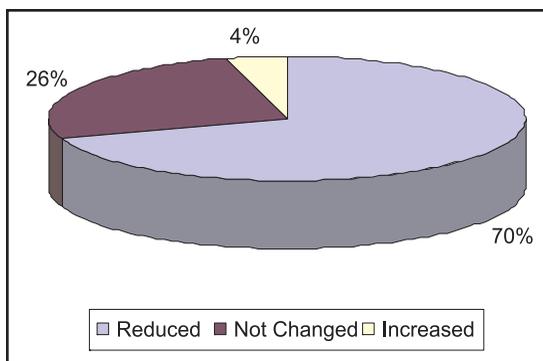


Figure 4. Time agents spend waiting for boats.

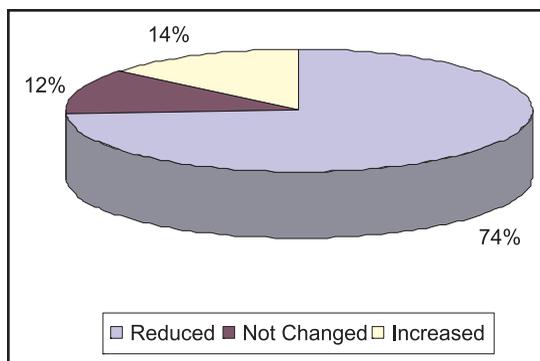


Figure 6. Perception of business risk since the introduction of mobiles.

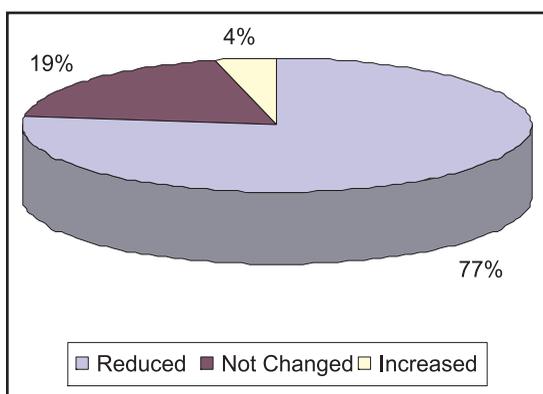


Figure 5. Time owners spend waiting for boats.

man holds over the fishermen due to the monopoly on price information has lessened somewhat. The free flow of information ensures the fishermen get the opportunity to drive a harder bargain than before.

Before the advent of mobile phones, another area of considerable wastage of time and resources for both owners and agents was the time spent waiting at harbors for their boats to land their catch. Now, owners and agents know exactly when and where their boats will come in and they can plan accordingly. Seventy percent of agents and 77% of owners said they spent less time waiting for their boats since they adopted mobile phones (Figures 4 and 5).

They spend the time thus saved working on business and personal issues. A few respondents claimed to have the time to run other businesses (footwear business, grocery store, etc.), thereby enhancing their productivity. In general, the owners

could spend the time saved getting ready for the sale of fish and dealing with miscellaneous issues like getting nets and engines repaired, getting fuel ready for the next expedition, and so on. In the survey, it appeared that owners spent more of the time saved on business related issues while agents spent more time looking after personal issues.

Reduced Risk and Uncertainty

For a large number of mobile phone users in the fishing community, the story of mobile phones is one of reduced risk and uncertainty. The ability to make informed decisions based on a continuous supply of information has greatly lowered the risks and losses of doing business in a highly volatile commodity. The removal of uncertainty from fish marketing has led to a reduction in losses. Almost three-quarters of the respondents surveyed believed that business risk had reduced considerably since they started using phones (Figure 6). Just over half of the respondents believed that losses had declined.

Neither the reduced risk nor the reduced losses seemed to translate into increased incomes. About 40% of respondents claimed that their incomes had gone up since they started using mobile phones, while about the same number claimed their incomes had stayed flat. This could be for several reasons, including the trouble with reporting any sort of increase in income to strangers. It could also be due to structural problems within an industry that supports many more people than it ought to. In principle, one could reduce one's losses, be subject to less risk and still earn relatively less than one did a few years back. The corollary is that without the reduc-

tion in risk and decreased losses, the drops in incomes may well be even higher.

Reduced risk also represents the greatest improvement in the quality of life for fishermen and transporters. Fishermen are now able to communicate problems such as failed engines and bad weather quickly. At the same time, their family members are now able to communicate emergencies and illnesses, giving the fishermen the option of returning as soon as possible. In a recent example, mobile phones were used to alert fishermen of the massive earthquake that hit Indonesia on March 28, 2005, and the dangerous Tsunami warnings in effect. Most of the fishermen, who had been hit hard by the Tsunami of December 26, 2004,¹³ returned to their bases immediately. The introduction of mobile phones has also lowered the sense of isolation that fishermen feel out at sea. Not only are they now able to stay in touch with friends and family, but some of the mobile phone companies also provide entertainment via mobile phones.¹⁴ Fishermen are also able to take care of personal business before they land their catch via mobile phones.

It comes as no surprise then that 86 percent of the respondents among fishermen felt safer and less isolated out at sea since they started using the mobile phones (Figure 7). Although large numbers of respondents in other categories felt the greatest benefit of mobile phones had been in business, almost 70 percent of fishermen claimed the greatest benefit was the newfound feeling of safety and security. They would probably feel a lot stronger about the business benefits too if not for the credit linkages described above.

Transporters can make productivity gains since they can ensure their vehicles are being used right through the day, whereas earlier, the trucks could potentially be empty for long periods of time. However, almost 50% of transporters surveyed said the greatest benefit to them from using mobile phones came at times of emergency or illness. Given the state of the roads and the vehicles they drive, transporters are frequently the victims of vehicle breakdowns or accidents and these incidents could

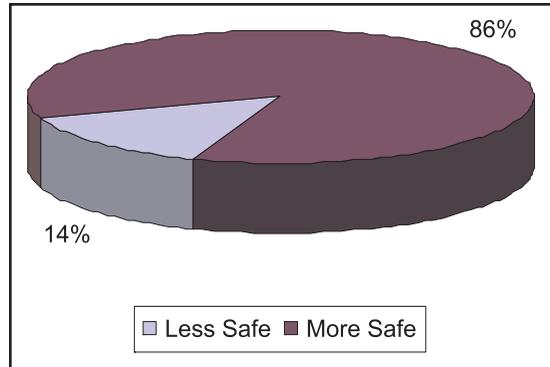


Figure 7. Do you (fishermen) feel safer out at sea?

occur in remote areas where no communication was possible before mobile phones. Fish is a highly perishable commodity, and the longer it takes to get to market, the lower its value. The ability to immediately alert merchants to any vehicle issues (and to ask for replacement vehicles to be sent) saves them money. Needless to say, transporters caught in emergencies in remote areas also feel safer if they are able to communicate their trouble and ask for help.

Less Widely Reported Uses

Finally, as with all technology, mobile phones have their unsavory uses, too. Merchants get long lines of credit from the auction agents they buy from. With mobile phones, it is actually possible to lie about location¹⁵ and therefore hold off paying for a day or two longer, unlike the situation with landlines, where one’s location was established by definition. Some agents are known to use mobile phones to coordinate threats and attacks on others, especially if they feel short-changed vis-à-vis financial issues.

A True Base of the Pyramid Market

Given the initially information-constrained market, 100,000 subscribers have been acquired with little effort on the part of the mobile phone companies. Because of the density of population in Kerala, the operators did not target the fishing community as a specific user segment but as part of a larger com-

13. According to conservative estimates, at least 150 members of the fishing community in Kerala lost their lives to the Tsunami.

14. Specifically, several fishermen were observed using the multimedia offerings at R-World, the multi-media portal offered free-of-charge by Reliance Telecom.

15. They can claim to be out of town for instance when in fact they are just looking for a way to avoid paying up.

munity of interest in a certain area. The return on investment is therefore very high. What it took to capture the market was a combination of lowered communication costs combined with an intimate knowledge of local market conditions and the unmet demand for information in the community. This is of great significance as more companies try to make profits from providing services to relatively poor communities.

Implications for Policy Makers

The idea that communications technology can be used to spur economic development is one that takes up a lot of bandwidth, in academic, governmental, nongovernmental/development agency and business circles. This article has provided an example of the value of communications technology, especially mobile phones, in making markets work more efficiently. This research also firmly establishes the role of ICTs in rural markets as one that reduces transactions costs. Investments made with the aim of reducing transactions costs are more likely to succeed than amorphous, ill-defined attempts to bridge the "digital divide."

Demand-driven, bottom-up interventions are more likely to succeed in developing countries than are top-down ones. The demand in this case can be gauged from the unsubsidized adoption of a service that Indian policy makers had assumed for years to be a luxury and a plaything of the rich. It is better for policy makers to create an effective regulatory/policy structure and then get out of the way, except in areas where market failures occur. This research project has provided evidence that the private sector can cater to the communication needs of the population well once the regulatory policy infrastructure is in place.

This research also proves the financial viability of private sector driven projects aimed at the bottom of the economic pyramid, an idea that scholars such as Prahalad (2004) and Hart (2005) have been trying to promote. The biases of Western business ideas play a part here since these markets do not conform to traditional ideas of what constitutes a profitable market. A little bit of creative thinking in providing services, especially services that are income enhancing or loss reducing, could go a long way in learning how to tap these markets. Letting the private sector find creative ways to unlock the hidden market po-

tential in rural areas should therefore be a priority for policy makers.

Speculations and Insights on Broader Issues

I started this research assuming that the use of mobile phones was mostly at the production end of the supply chain. In fact, I found that most of the usage occurred at the marketing end. The reasons for this have been discussed above. There is an important point here that must be noted: people at the marketing end of the supply chain tend to be better off and more sophisticated than the fishermen at the production end. As a result, they have better access to capital, which lets them leverage the use of mobile phones into real gains for themselves. In effect, we could argue that mobile phones may actually increase inequality in the short run, a conclusion shared by Forestier, Grace, and Kenny (2002). Unlike them though, I did find a significant improvement in quality-of-life variables since the introduction of mobile phones.

As part of the efforts to bridge the digital divide, several policy makers have suggested that widespread diffusion of computing and the Internet would benefit the poor a great deal. To test this assumption a little bit, all of the respondents in the survey were asked how widely they used SMS services, the most prominent data service available on mobile phones. Less than one-third replied in the affirmative. Even among the SMS users, there was a very high correlation between a college education and use of SMS services. Twenty-three of 34 respondents (68%) with a college education had used SMS, while only 28 of 122 respondents (22%) without a college education had done so. Data services require a level of sophistication that many economically deprived people living in rural areas may not possess. Mobile phones, on the other hand, represent a continuation of the oral tradition which most people are comfortable with. Unloading computers and data services in rural communities may not therefore provide the greatest bang for the economic development buck.

Conclusion

I remain cautiously optimistic about the impact that communication technologies have in rural communities in developing countries. This project has demon-

strated that markets were made more efficient by the introduction of mobile phones and the subsequent free flows of information. It is even possible that the introduction of mobile phones enhanced productivity. Some broad parameters for technological interventions to work in rural and undeveloped markets have also been identified:

1. The price point is key for adoption of any innovation (no matter how useful) to take off.
2. Local knowledge is absolutely necessary to identify market opportunities.
3. There are large information asymmetries in these markets, but they can be remedied by the creative use of technology.
4. Point 3 is subject to a major caveat—namely, easy access to capital, which is necessary if users are to take advantage of the opportunities presented by freer information flows.

The last point serves as a reminder to not exaggerate the role of communications technology. When the respondents in the survey were asked which technological improvement made the most difference to them, mobile phones came in third to mechanization and improved roads and transportation. Even assuming that better roads and transportation scored so high because of the larger number of merchants surveyed, it puts the role of mobile phones in perspective.

Finally, it would seem that the impact of mobile phones in developing countries is lower than the impact of the telegraph in the United States. The introduction of the telegraph spawned everything from futures markets to new organizational structures. However, we need to keep in mind that the impact of the telegraph revealed itself over a 40–50-year time frame, while the impact of mobile telephony has been studied merely over a 3–4-year period. Even assuming that things have speeded up quite a bit in the last century, it will probably take a while longer to assess the true impact of mobile telephony in developing countries. What’s more, it is difficult to assess impact in the midst of the diffusion process for a new technology. We may only find out about 10 years from now. ■

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