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Research Article

On the Importance of Price Information to Fishers and to Economists: Revisiting Mobile Phone Use Among Fishers in Kerala

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Abstract

In this article, we revisit a study that has become canonical in ICTD, economist Robert Jensen's study of mobile phone use in fishing markets in north Kerala. Jensen found that the use of mobile phones to share market price information made fish markets more efficient, while also improving producer and consumer welfare. Based on our own ethnographic case study in the region, we examine the historical, geographic, and political-economic conditions in which Jensen's findings hold. We show that north Kerala's coastal geography and prevalent credit relationships make it a special case of fish trading where fishers had the flexibility to optimize profits by selling at different markets. Fishers' ability to leverage mobile phones for sharing price information derived from this flexibility. Moreover, we found a broader definition of welfare at play that went beyond increased income. Those working in various roles in Kerala's fishing industry emphasized a spectrum of benefits from phone use, including maintaining trade relations, facilitating coordination, and protecting themselves during times of risk, vulnerability, or emergency. We suggest that parsimonious models, such as Jensen's, can generate blind spots, which are problematic when such studies are used to draw broader conclusions about policy and technology design.

1. Introduction

In this article, we return to the site of a canonical work in ICTD, Robert Jensen's study of mobile phone use among fishermen in Kerala, India (Jensen, 2007).² Jensen's study, carried out within the disciplinary tradition of economics, finds that the use of mobile phones to share market price information has made fish markets more efficient and improved both producer and consumer welfare. Our goal in this article is to understand more fully the geographic and political-economic conditions in which Jensen's findings hold.

Taking seriously the question of multidisciplinary in ICTD, we consider what alternative explanations or additional details might come to light when we employ an altogether different methodological approach grounded in different epistemological commitments toward studying the same geographic site and population, and to broadly consider the same topic as Jensen: how mobile phones are incorporated into fishing practices. Our work is framed around an ethnographic case study carried out in north Kerala, the region

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1. The coauthors contributed equally to conceptualizing and writing this paper.

2. Jensen uses the term "fishermen" in his work and we maintain this term when referring to his study throughout this article. In describing our own field research and in our analysis, we use "fishers," a term we find more inclusive. This difference is especially worth pointing out since one of our goals is to expand Jensen's categories.

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where Jensen's study was conducted. We believe the questions that we raise and attempt to answer are of cross-disciplinary interest. Our work also speaks to a broader concern in ICTD with the way research findings are translated into policy practices or design strategies.

Based on our research in north Kerala, we arrived at four conclusions. (1) We found that the history of organizing among fishers as well as migration flows shaped prevalent investment and credit relationships in such a way that fishers had the flexibility to sell at different markets. (2) We found that only specific categories of actors found price information critical in making trading decisions and regularly used phones to ascertain it. (3) We found that a majority of those at the fish market were using mobile phones in a much wider range of activities related to their livelihoods. (4) While a majority of these individuals perceived mobile phones as having enhanced their livelihoods and well-being, their implicit definitions of *welfare* rarely focused on improved incomes alone, emphasizing instead how they used their phones to maintain relations within and outside the market and to protect themselves during times of risk, vulnerability, or emergency. In light of these conclusions, it is worth considering how such models as Jensen's, which omit many significant aspects of the north Kerala market toward the aim of parsimony, may end up representing particular markets as more "free" than is warranted and potentially blind us to the power dynamics that shape such a market's daily workings.

The article is structured as follows. We begin with a detailed description of Jensen's study and highlight findings pertaining to prices and phone use that proved to be of particular interest in our field study. Next, we describe our methods and the workings of a fish market in north Kerala, paying particular attention to who uses phones and how. The following section analyzes the broader use of phones among actors in the north Kerala fish supply chain. Finally, we present our conclusions.

2. The Matter of Mechanisms

Robert Jensen's article, "The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector," is an econometric study of the impact of mobile phones on price in a number of north Kerala beach markets (Jensen, 2007). Anticipating the arrival of mobile phone coverage in the region, Jensen and his research team initiated survey work in 1996, prior to the arrival of phones. They continued this work after mobile phone towers were erected in the region and mobile phones began to proliferate among those working in the fishing industry. Survey data was collected weekly for almost five years from 20 fishing units (10 large,³ 10 small) in 15 beach markets, for a total of 300 fishing units. For the purposes of the article, the details about quantity of fish, sale prices, and the particular beach market where they were sold were critical to Jensen's subsequent argument about the role of the mobile phone in addressing information asymmetries that hamper market efficiency.

Jensen's study addressed differences in the price of fish (specifically, sardines) across geographically dispersed beach markets. Prior to the arrival of the mobile phone in north Kerala, learning the price of fish at a particular beach market meant physically travelling there, leading to high "search costs" that included fuel expenditures and lost time, the latter a special problem for a perishable good like fish. Instead, fishers generally went straight to the market closest to their catchment area. The result was that, on any given day, some beach markets were oversupplied with fish, while others were undersupplied, yielding substantial price differences at each of these markets. The term for this is *price dispersion*, and it indicates an inefficient market. Jensen perceived that the arrival of mobile phones had the potential to drastically reduce search costs and that measuring the resultant change in market efficiency would provide evidence of the impact of mobile phones. He describes the research design as a "natural experiment." As for the results of the study, Jensen found that prices per kilogram of sardines fluctuated fairly wildly at first, stabilizing almost immediately into a narrow range shortly after the date the phone network became available in each of three regions. His evidence shows convincingly that price dispersion was reduced with the arrival of the mobile phone.⁴

An additional important consideration in Jensen's account is the matter of welfare effects. Jensen argues that "for the world's poorest, living standards are determined largely by how much they get for their output,"

3. Where large is defined as a unit with a boat length of 28 feet or longer.

4. This finding is illustrated in Figure 4 of Jensen's article.

(Ibid., p. 880) and that ICTs such as mobile phones “may help poorly functioning markets work better and thereby increase incomes and/or lower consumer prices” (Ibid., p. 881). Indeed, Jensen found that in addition to a general improvement in market efficiency, fishermen gained about 8% in profits, while consumers paid about 4% less for sardines. In his elaboration of welfare gains, Jensen acknowledges that it was primarily the largest fishermen who adopted mobile phones, but that the smaller fishermen still realized spillover gains (that is, increased profits) from improved market efficiency, even though they did not use the phone directly and even though they were not themselves able to carry out arbitrage practices. The reason for this, he posits, is that the smaller, nonphone-using fishing units “no longer have days with unsold fish because boats with phones will switch to other markets when the local catch is high” (Ibid., p. 917).

We give further attention to how Jensen describes the *mechanisms* at play in the article in light of our own interest in examining these directly in our case study. How exactly is the mobile phone enrolled in this process of fish marketing? Jensen asserts that

the phones were widely used for fish marketing; while almost all sales before mobile phones were conducted via beach auctions, fishermen with phones, often carrying lists with the numbers of dozens or even hundreds of potential buyers, would typically call several buyers in different markets before deciding where to sell their catch, in essence conducting a virtual auction, and committing to a price while at sea. (pp. 891–892)

This is the extent to which the actual practice of mobile phone use among north Kerala’s fishers is specified in the article. While the quantitative data that forms the substance of Jensen’s argument about the reduction of price dispersion is collected systematically, details on exactly how fishers use phones are sparse in his account and lack the same kind of transparency about how such insights were acquired. Some of these details are deprioritized to footnotes. This is (broadly) a reflection of what counts as evidence in econometric analysis. Collected prices are data, but details on processes are merely background or explanatory material.

Jensen mentions other temporal and spatial constraints on trade that determined fish marketing practices prior to the mobile phone and that were unchanged after its arrival. Specifically, he comments on the perishability of fish, the inability to store fish, and the narrow window of time when fish markets are open—all reasons why better price information is likely to have an impact in this particular market. He points also to the absence of two particular constraints, that of “interlinked transactions,” the case “when a fisherman receives credit from a buyer and in exchange must always sell to them” (Ibid., p. 897) and “collusion” among sellers or buyers to “punish” those involved in sales to nonlocals (Ibid.). Both conditions could (if present) prevent market efficiency improvements despite better price information. By identifying these, Jensen gives some indication of what to look for in other sites to determine whether such findings will generalize to new locales.

3. Method

We used a comparative analysis of the model presented by Jensen and of what we found returning to the region where the model was derived 11 years after the completion of Jensen’s survey which was carried out between 1996 and 2001. We relied initially on Jensen’s account for our baseline understanding of the mechanisms underlying fish marketing activities. We used his article to frame a set of questions around mobile phone use, price acquisition, and arbitrage work. However, where Jensen works backward from indirect empirical evidence to an understanding of how mobile phones impact market efficiency and welfare in the fishing industry, our aim was to understand the mechanisms directly. In other words, what precisely are the practices of phone use around fish marketing in Kerala? And besides fish marketing, what other value do fishers and others in the fishing supply chain attach to the mobile phone in their livelihood activities?

We were drawn to examine Jensen’s article, in part because of its influence in the field of ICTD and its apparent impact on broader public understanding of mobile phone diffusion in the ‘developing’ world. The article received considerable media coverage.⁵ Additionally it is considered exemplary in the disciplinary

5. See “To Do with the Price of Fish” in *The Economist*, May 10, 2007 and “Dial ‘M’ for ‘Mackerel’: Can a New Mobile Phone Service in Rural India Help Promote Economic Empowerment?” in *The Wall Street Journal*, August 26, 2009.

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tradition it belongs to in terms of its research design, execution, and notable findings. The prestigious venue of its publication⁶ is evidence of this. We contend that in fields such as ICTD, where multiple disciplines intersect, conversations about disciplinary approach and methods (and their strengths and shortcomings) are challenging but necessary. Furthermore, we argue that such conversations are most productively carried out by examining cases that are recognized as best-in-class. Our close consideration of Jensen's article and our revisit of the site of the work functions not so much as a direct critique of his model, but more broadly as an examination of the way models and methods construct representations. Ways of understanding human behavior in any disciplinary tradition that deals with the social (including economics, sociology, anthropology, and human-oriented domains of computer science such as HCI) are always at least slightly skewed by the constructs, values, and priorities of that discipline. Our attempt here is to offer a concrete example of *how* this disciplinary skew operates and its broader ramifications for questions of application (to policy and technology design in particular).

While Jensen's approach was econometric, ours is an ethnographic case study. Our goal was to account for a more complete story of the fishing industry in this region, its economic and political history, and how the industry in question is situated globally. Our purpose was to unpack the elements that Jensen reduced to essentials, to render the setting in its full complexity through holistic description. We were conscious that Jensen's work was conducted at a time when phones were just being introduced in the region, and that 11 years have elapsed since then. Our work was therefore not structured as a restudy of an unchanged fieldsite, nor was our aim to disprove Jensen's model. In particular, we did not find reason to refute the essential soundness of Jensen's findings regarding the role mobile phones played in improving market efficiency. Furthermore, coming from such epistemologically divergent positions, the parsimonious economic model and the ethnographic case study are not directly commensurable, although we believe they can be fruitfully put into a dialogue.

What is the purpose of making a complex mess from such a compelling and clear model? In part, our goal was to speak to visions of scaling and to the potential for such models to be universally applicable. A widespread desire in the aid sector to quickly and widely scale "proven" solutions makes the question of generalizing from cases (such as Jensen's) critical in the ICTD research field with its intimate ties to that sector. An example of such scaling is the proliferation of price information platforms worldwide encouraged at least partially by Jensen's findings on mobile phones, price dispersion, and welfare in north Kerala. The current popularity of randomized-controlled trials as a way to establish what kinds of aid interventions work has also generated discussions with critics, who note that a positive finding in one setting is not predictive of the same outcomes in any other (Barrett & Carter, 2010; Duflo, Glennerster, & Keremer, 2007; Rodrik, 2008).

Over the course of three months of fieldwork in 2012, we conducted 80 formal interviews and several more unstructured conversations in Kerala. Most interviews were conducted in Malayalam with the assistance of a translator and were recorded. We spoke with people employed across the fishing supply chain, including fishers who owned boats, fishers who worked on other people's boats, buyers who bought wholesale, other buyers who liaised with fish meal factories or operated as export agents, and small-scale fish vendors (operating on bike and foot, male and female). We also spoke with the investor-auctioneers who mediated between fishers and buyers, taking a cut of the profits and/or earning a commission. Organizing among fishers was prominent in Kerala's fishing industry, so we spoke with employees of fishers' cooperatives (both fisher-organized and those affiliated with the government-sponsored federation of fishers' cooperative societies, Matsyafed) and to members of fishers' unions at both the state and village level. Finally we spoke with several experts and researchers, some of whom also self-identified as activists. We acquired publications by the government and by fishers' cooperatives and unpublished research articles. All these sources and perspectives were brought together to form the case study we present below. To allow readers an opportunity to assess our sources in relation to statements attributed to them, we identify them in footnotes by their pseudonym (or real name in the case of activists, researchers, and officeholders of fishing cooperatives), industry role, location, and the date of our interviews.

6. *The Quarterly Journal of Economics* is often ranked at or among the top journals in the field.

4. Complicating the Model in North Kerala

In this section, we explicate several trends and events in north Kerala's fishing industry that made it an ideal setting in which the introduction of mobile phones would lead to improvements in market efficiency and to market mechanisms that could generate welfare gains for both small- and large-scale fishing units. We find that the groundwork for the functioning of these markets was accomplished, in part, through interventions into a prior monopsonistic order. Particularly important was the formation of government-run and fisher-organized societies that invested in fishing equipment and also systematized an auctioneering system on the Kerala coast. These *regulatory* interventions, we argue, fundamentally reshaped prior buyer-seller relationships that were detrimental, especially to fishers. We also point to the history of mechanization and fish exportation that has shaped the adoption of new technologies and structures of marketing fish in Kerala. Thereafter, we analyze a landing center in north Kerala, situating its working both within the state-level developments outlined above and within the region's particular geography and social order. The goal of taking such a political-economic view that recognizes "the mutual determination of political processes and economic activity in a historically viewed world system of nation-states" is to enable us to probe further into the possibilities of generalizing from the north Kerala case (Marcus & Fischer, 1986, p. 79).

4.1 The Political Economy of Fishing in Kerala

Kurien remarks that Kerala's fish economy has historically had three crucial components: natural resources, skilled labor power, and techniques, all of which the region possessed or developed over time (Kurien, 1985). However, these factors are far from uniform along the 590-kilometer coastline of Kerala for both historical and geographical reasons (Kurien, 2000). Nor are the skillsets and techniques constant across seasons. The region's artisanal fishers have historically used several combinations of boat and gear to catch different varieties of fish and in different seasons (Kurien, 1985, 2000; D'Cruz, 1999). Large boats were used in the north, but these could not be used in south Kerala, with its steep ocean floor and rough surf. During monsoons, many southern landing sites were dangerous, even for small boats. The prevalence of different species of fish in the two regions meant gear varied as well. The specific boat types and gear have changed since Kurien's study, but his findings—on the relative size of craft across the north and south, the seasonality of safe landing spots in the south, and differences in fishing gear—hold. We do not address these variations between north and south Kerala at length in this article. But we do show how these additional factors (including the uncontrollable factors of geography and topography) contributed to the specific baseline conditions of trading fish in north Kerala that, in turn, allowed market price information (via mobile phones) to alter the region's market efficiency.

The varied equipment and techniques used on the Kerala coast have a long history, but the relatively recent Indo-Norwegian Project (INP) has also significantly shaped the Kerala fishing economy.⁷ Started in 1953, INP's goal was to modernize the fishing sector, focusing mainly on the use of mechanized craft and on exports. While INP itself functioned only until the mid-1960s, it fundamentally shaped the technology and relations of production involved in Kerala's fishing sector ever since. For our purposes, it is important to note that fishing now takes place deeper in the ocean than before, using powerful motors and large boats, especially trawlers. Further, trawling nets catch everything in their path, unlike traditional nets that target specific fish varieties. As trawlers landed bulk catches of fish, improved freezing and canning facilities helped process them for export. Even as exports skyrocketed in this period, artisanal fishers, who operated nonmotorized craft, protested against these changes in the fishing economy. With the entry of trawlers and overfishing, it was increasingly harder for the artisanal fishers to find fish. Nor could they hope to compete, given the substantial capital investments required for large boats. As their problems intensified, artisanal fishers themselves began to use outboard motors (OBMs) on their fishing craft by the 1980s. They combined OBMs with newly introduced

7. Interviews in Thiruvananthapuram with John Kurien, an academic-activist, and Vivekanandan, a former SIFFS director (July 26, 2012); T. Peter, KSMTF president (August 6, 2012); Maglin Peter, convener of Theera Desa Mahila Vedi (an organization of fisherwomen; September 9, 2012); and Julian Telar, chief executive, SIFFS (September 11, 2012). See Hapke (1996), Klausen (1968), and Kurien (1985, 1992) for more on the INP and its aftereffects.

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plywood boats (*vallams*) to go farther into the ocean to catch fish (Gillet, 1985; Kurien, 1995a; Vivekanandan, 2002).

In addition to the adoption of new technologies, since at least the 1960s fishers have been involved in collective action to pressure the government to make structural changes to the Kerala fish economy. Several fish workers' unions (*Kerala Swatantra Matsya Thozhilali Federation*, KSMTF, being a prominent example) and a federation of fishing cooperatives, the South Indian Federation of Fishing Societies (SIFFS), were formed in the 1980s, and have been prominent in organizing fishers. These groups were formed to respond to the after-effects of mechanization and the export drive, but also to the historically exploitative relationship between fishers and middlemen-financiers.

Historically, middlemen-financiers would advance an amount to boat owners and, in exchange, buy their catch at whatever price they deemed appropriate.⁸ One of SIFFS' goals was to ensure that fishers received a better price at the first point of sale on the shore. Toward this goal, it worked with village-level fishing societies that offered fishers loans to buy their equipment and it hired an auctioneer. The auctioneer worked on behalf of fishers to auction their fish for the best possible price and hand over a fixed percentage of the sales revenue to the fishers. This streamlining of auctions has by all accounts been crucial to the way fish are bought and sold in landing centers in many parts of Kerala today. Many fishers' societies and unions have been formed since that time, including a government-sponsored federation of fishers' cooperative societies, Matsyafed. These societies also provide loans to purchase craft and gear. Over time, these new investment sources and the auction system have posed some competition to private investors, thus shaping the dynamics at landing centers. SIFFS has also been instrumental in the development and manufacture of the plywood boats that now proliferate in Kerala's coastal waters. Meanwhile, the protests organized by fishers' unions on issues such as over-fishing, the institution of a trawling ban, or the entry of outside ships into Kerala waters have also impacted fishing policy and regulations in Kerala today.

Several other factors, some not specifically related to fishing at first glance, have also shaped Kerala's fishing sector. The north Kerala coast has a predominantly Muslim population, while the southern coast is largely Christian. The prevalence of migration and the volume of capital available for investment in the fishing sector are related to religion.⁹ Kerala has seen high rates of migration to the Middle East since the 1970s, with the north Kerala region sending the most emigrants abroad (Zachariah, Mathew & Rajan, 1999). Remittances from emigrants and returnees from the Middle East form an important source of private investment in the fishing sector, especially in the predominantly Muslim north.¹⁰

Having outlined important changes in the political economy of the Kerala fishing sector in the past decades, and pointed to some differences between the north and the south, we see how these shape the workings of the Chaliyam landing center in Kozhikode district, north Kerala.

4.2 The Case of a Landing Center in North Kerala

Fish for the Chaliyam beach market arrived on mechanized minitrawlers, motorized ring-seine units (60+ feet long), gillnet units with internal motors (typically up to 36 feet), smaller boats called *vallams* that use external motors (OBMs), and oar-operated boats.¹¹ The gear used for fishing included trawl nets, ring-seines, different sizes and types of gillnets and hook-and-lines. Thus, a range of boat sizes and gear operated in Chaliyam, leading to more combinations than the two categories of small and large fishing units offered in Jensen's article.

8. Fishers sell their catch to merchants at low prices, compelled by the perishability of fish, lack of access to a marketing infrastructure, and the threat of physical violence if they sell elsewhere. Merchants also control the land on which fishers live. See Hapke (1996), Kurien (1984), and Kurien and Willman (1982) for details on the fish supply chain along the Kerala coast.

9. As is the participation of women in the industry. Women are absent in publicly visible roles in north Kerala due to religious observance. They are involved in large numbers as small-scale vendors in south Kerala (Hapke, 1996; Kurien, 1995b, 2000; Subramanian, 2009).

10. Interview with Jolly, an SIFFS Malabar coordinator in Kozhikode (October 23, 2012).

11. By one estimate, in Chaliyam there are 75–100 gillnet units, 125 small boats with OBMs, 15–20 manually operated boats, 10–25 vessels for mussel fishing (medium sized, about 35 feet), seven ring-seine boats, and six mechanized boats. From an interview with Ismail, a private investor-auctioneer (September 27, 2012).

These combinations differed in terms of the volume and varieties of fish they caught, their revenues, and their investment, ownership, and revenue distribution models. Next we examine the principal boat types used for sardine fishing in the region: ring-seine units and gillnet boats.¹²

Ring-seines encircle pelagic fish such as sardines and mackerel to capture them.¹³ A ring-seine unit included a main boat and carrier boats to ferry the catch, the fishing gear, and a crew of 45–50 people. A unit required an initial investment of 60–75 lakh rupees¹⁴ on the boats, engine, and nets. Periodic investments in repairs or replacement of damaged nets, engines, or the boat could range between tens of thousands and a few lakh rupees. Ring-seine units were typically owned collectively, but because of the scale of investment and expenses, they also needed external investors. Of the crew, 25–35 were share-owners, with an investment of about a lakh rupees each. External sources, such as private investors (of whom Chaliyam had several, many of whom had invested their earnings from the time they were working in the Middle East) or loans from fishers' societies (three groups affiliated with the state-led Matsyafed and a weak group affiliated with SIFFS) provided the rest. In return, the primary private investor (typically having invested 10 lakh rupees or more) or a society-appointed auctioneer in the case of society loans received the right to auction the boat's catch on that shore. In addition, these investors received a commission on the sales revenue. Other private investors, who typically provided amounts for repair or smaller amounts as capital, were strategically chosen from nearby landing sites, of which there were many, to ensure that a unit had auctioneers on whichever shore it chose to sell its catch on a given day. On a day with a good catch, ring-seine units could use up to four carrier boats, each with a capacity to store 4–6 tons of fish.¹⁵ These units primarily brought back sardines, but also some mackerel and prawns during their season (June–August). We were informed that the earnings from a trip (sales revenue minus expenses including commission, fuel, food, loan repayment) were distributed among capital (fishers who had a share in the boat) and labor (everyone who went to sea, regardless of whether they had a share in the boat or not) in a 40:60 ratio.

Gillnet units use nets to trap the fish that swim into them by entangling their gills in the mesh (hence “gill” net).¹⁶ We found that these boats use a 4–5-member crew and different gillnets to selectively catch seer fish, tuna, mackerel, pomfret, and anchovies in addition to sardines. Being much smaller than ring-seine units, gillnet units cost substantially less, typically 6–10 lakh rupees depending on their size, type (external or internal motors), storage capacity, and nets in use. They typically had a single owner, who contributed part of the capital. External sources (private investors, society loans, bank loans) provided the rest. Much as in the ring-seine units, these external investors auctioned the catch from the boats they invested in, receiving a commission on the sales in return. Because of the relatively small capital involved, gillnet boat owners had only one external investor. If they borrowed anything from investors in other locations, the amount was usually low, typically in tens of thousands of rupees. Gillnet boats brought back 400–500 kg of fish on average, and a maximum of 1,000–1,500 kg. The earnings from a trip (sales revenue minus expenses such as commission, loan repayment, fuel, food) were divided into equal parts, with one part given to the boat owner, one to the engine owner, and one part each to the workers.

At the other end, the Chaliyam fish buyers were also of several kinds: purchasers who bought for export companies, wholesale merchants, and small-scale vendors. The purchasers and wholesale vendors bought large volumes of fish that they sent to processing facilities (peeling for export, powdering for fishmeal

12. In Jensen's account, he uses boat size as a proxy for volume of fish brought in. It works reasonably well for his analysis, although we find the 28-foot specification to be arbitrary as it is inclusive (among boats that fish primarily for sardines) of all ring-seine boats, but only some of the boats that use gillnets and not others (since these boats range typically from 24–36 feet). We found that the descriptive fishing unit “type” was more consequential for categorizing fishers, their marketing practices, and phone use, as we detail in this section.

13. Ring-seine units use a motorized craft to get ahead of a shoal of fish and encircle it. A large crew operates the net to capture an encircled shoal. See Edwin & Hridayanathan (1996) or Kurien (2000) for the history and operation of ring-seines.

14. US\$1 = 55.911 Indian rupees (based on IRS average yearly exchange rate for 2012). 1 lakh = 0.1 million.

15. The numbers we use for the catch volume and distribution of trip earnings derive from interviews with Ismail, a private investor-auctioneer (September 27, 2012) and members of a ring-seine unit (October 25, 2012).

16. See Thomas (2001) on types of gillnets.

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production), domestic markets, or export agencies. An agent for a fishmeal factory in Mangalore, who had started operations in 2002, was also a bulk buyer and acted as an assured buyer of sardines of a range of qualities. Small-scale vendors bought only a few baskets of fish that they could transport by auto or moped. They sold in nearby markets, to restaurants, at roadside stalls, and to individual homes in fixed neighborhoods. The diversity among buyers meant that different types of buyers used price and supply information in different ways when buying and selling fish.

Next we consider how this effort to differentiate the types of fish producers and the types of buyers relates to the question of price information on which Jensen's findings focused. We argue that different producers and buyers in Chaliyam regarded "price information" differently. Because of these differences, the relationship between mobile phone use and price varied across these groups.

4.3 The Importance of Knowing Prices (or Not) and the Role of the Mobile Phone

Among the different categories of producers, price mattered most to ring-seine unit owners. These units brought in large volumes of fish, which made them sensitive to even slight variations in unit price in different markets. Furthermore, these owners borrowed from multiple investors, depending on the scale of their investment. By choosing their investors strategically, they had an auctioneer at different markets through whom they could sell without much of the inconvenience and unpredictability involved in selling at an unknown market.¹⁷ These boat owners used their mobile phones as soon as they came within range to call their auctioneers at different landing sites to ascertain prices.

Those fishing on gillnet boats, on the other hand, brought in much less catch overall, with the lower catch further spread among multiple fish varieties. As a consequence, these fishers required a much greater difference in price per unit to find it profitable to transport the fish to a market with a higher per-unit price. They typically tended to fish and sell in Chaliyam. As many fishers told us, to the extent possible they preferred to sell their fish as soon as possible at a place they knew, then return home to rest their exhausted bodies after long hours (or days) at sea. To the extent that these fishers sold elsewhere, they said it happens when they found fish closer to other markets and not because these markets offered better prices.¹⁸ In both the ring-seine and gillnet instances, fishing units almost always called their auctioneer, rather than the buyers directly, to talk about prices or what they had caught.

Among buyers, the wholesale merchants, export purchasers, and fishmeal agents were more likely than the small-scale vendors to find price critical. Additionally, details on the availability of different varieties and specific volumes at a landing center were also critical to export purchasers, whose calculations changed in accordance with daily instructions from their export companies. Export companies, in turn, based their daily calculations of acceptable price and required volume on currency exchange rates and international demand. The mobile phone was used regularly to conduct these conversations. Before the mobile phone, these conversations were conducted on landline phones at the offices or homes of export agents.

Small-scale vendors, on the other hand, came to the same beach market every day. They varied the quantities or varieties they purchased in response to the changing prices they found at the shore. However, absent very low supplies, these variations seldom drove them to other markets. Such vendors also mentioned having some leeway in how they priced their fish for regular customers. They set prices to ensure they did not suffer losses, regardless of the prices at the shore.¹⁹

Thus, learning the prevailing fish price prior to deciding where to sell mattered to different degrees across Chaliyam's range of fish sellers and buyers. Their use of the phone to find out prices, consequently, also varied. In summary, it mattered most at higher volumes of fish, at higher investment levels, and with higher profit

17. Interview with Kamaluddin, a gillnet boat owner, whose boat was financed by a single private investor (October 23, 2012). Speaking of the difficulties of selling in other locations, he explained, "If we land at a different place than the one we are from, we don't know enough about the market, agents, purchasers, so we need the help of someone."

18. Conversation with Kamaluddin, a gillnet boat owner (October 25, 2012), who told us he had sold fish elsewhere only 5–6 times in the past year and those times were because they had fished elsewhere.

19. Nooruddin, a cycle-based vendor, noted that he followed a fixed route to sell fish, adding, "I buy only fresh fish from here, so all of my customers have faith in me. They purchase even when the rate is high" (October 25, 2012).

opportunities and, thus, more to fishers, investors, and buyers who were the (relatively) more affluent market actors in the industry.

4.4 What Complicating the Model Tells Us

Generally speaking, we find a broad congruence between the use of phones for price information gathering and arbitrage work at our north Kerala site and Jensen's claims about these uses in this region. A former fisher, now an investor, commented that the phone helped fishers "determine where to sell their catch."²⁰ A wholesale buyer noted that fishers used the phone to "find best prices" and that before the phone's arrival, fishers would "just sell at the nearest landing site."²¹ It was not only the fishers who initiated this practice; for example, a Matsyafed auctioneer said,

[I]f price is low here, we call and tell [the fishers] to land in other ports where price is high . . . they call us and we tell them. . . . If a boat has a catch of [valuable] fish, they will immediately call us. Following that, we call the major markets in Kerala to know the price.²²

Such accounts confirm that practices of spatial arbitrage using the mobile phone do exist and endure (among certain types of fishers and buyers) in this environment despite the lapse in years between Jensen's account and our study. Furthermore, these accounts confirm that actors in the fishing supply chain recognize the mobile phone as initiating a change in practice, the impact of which Jensen aptly measured.

By complicating the model, however, we have been able to recover what it was specifically about this industry in north Kerala that was omitted from Jensen's account. We elaborated the diversity of roles within the broad categories of "producers" and "buyers" and discovered roles never mentioned such as that of the investor-auctioneers. Furthermore, we recovered details about the processes of collective organizing, regulation, and investment flows, all features of the industry that we suggest enabled the mobile phone to be as impactful as it was.

Jensen's market actors were represented as atomistic, highly competitive, and focused on self-interested optimization. As a result, roles and processes that pertained to the work of collectives (unions and fishers' societies) and forms of cooperation went unmentioned. That the history of collectives did not figure into Jensen's model is no surprise, given the disciplinary interests and epistemological assumptions that shaped it. We argue, however, that this history has to be brought into focus if we are to more fully understand the circulation of price information or of mobile phones in the fishing supply chain. The characterization of exchange as happening between producers and buyers directly (omitting the mediation of auctioneers) is also an important discrepancy between Jensen's account and ours.²³ This discrepancy is unlikely to alter Jensen's overall findings regarding price dispersion. But when considering the implications for policy and design that might be drawn from this type of study, we argue that this discrepancy has consequences. This is worth acknowledging as Jensen's study has had a life far beyond the community of development economists it addresses as its primary audience. For example, a prevalent policy thrust that informs ICT interventions associates the availability of price information using ICTs with bypassing middlemen.²⁴ From the Kerala case, where society auctioneers were *introduced* between buyer and seller to reduce the exploitation of fishers, we see how the presence of middlemen cannot automatically be assumed to introduce exploitation in a market. Moreover, when we shift our focus to the auctioneer as the person doing more marketing work than fishers, we introduce the possibility of understanding other uses fishers have for phones.

Our findings also challenge the notion that we can adequately talk about information apart from capital and investment, even in settings where capital supply seems sufficient and its flow relatively unencumbered.

20. Interview with Ismail, a private investor-auctioneer (September 27, 2012).

21. Interview with Suresh, a wholesale buyer based in nearby Koyilandi, who frequently bought fish from nearby markets (September 29, 2012).

22. Conversation with Shajahan, a Matsyafed auctioneer (October 10, 2012).

23. As Peer Mohammad, a fish wholesaler and export agent, noted, "No boat will directly call the market. They will only call their [auctioneer] in different markets" (October 10, 2012).

24. For example, see the World Economic Forum's global IT report (2008–2009), which explicitly states that Jensen's work shows how mobile phones "reduced the role" of "middlemen" (Dutta & Mia, 2009, p. 60).

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Received wisdom in ICTD suggests that anyone can act on information: The central challenge is to reduce the costs of acquiring information such that everyone can acquire it, regardless of their socioeconomic circumstances. Omitting a discussion of the distribution of capital and the nature of investment in this industry (as Jensen does) protects this notion and ignores how capital flows shape an individual's ability to act on information within prevalent trade relations and practices. In fact, we found evidence of interlinked transactions (that limit fishing units to sell only to those who had offered them credit) and of collusion among buyers to artificially lower prices.²⁵ This is another discrepancy between our account and Jensen's, since he suggests that interlinked transactions and collusion did not exist in this region. In general, we found that information about prices did not travel as impersonally as it seems in Jensen's account. We did not find evidence of direct selling to strangers based purely on the best price. Instead, we found trade practices based on longstanding relationships and negotiations.

5. Mobile Phones and Other Technologies

We have examined the types of market actors in Kerala's fishing industry for whom the phone has proved useful specifically for acquiring price information and doing spatial arbitrage work, the particular mobile phone practice that was the focus of Jensen's analysis. In this section, we broaden our consideration of the mobile phone to discuss the varied uses that were emphasized by different roles in the fishing industry. We suggest that the seeking of market price information via mobile phones should not be given an overprivileged role. Our goal here is to relate mobile phone uses to a more fine-grained understanding of income levels and socio-demographic distinctions and, thus, to an expanded notion of welfare as diversely defined by those working in the fishing industry.

At the time Jensen wrote his article, phones cost 5,000 rupees on average, and there was a clear division between those who owned a phone and those who did not. By the time we conducted our study, phones could be purchased for as little as 700 rupees, and many owned multiple phones. No boat went out to sea without a phone (and most typically had multiple handsets) onboard. Nor was this restricted to fishers. An auctioneer told us, "There's no business here without mobiles,"²⁶ and we heard this from almost all categories of actors. Jensen's focus on who possessed phones and who did not is, therefore, less significant today than it was during his study. The more interesting question today is how phones are being used by different categories of users. In addition, we saw that other technologies such as GPS and echo sounders have become popular since Jensen's study, making it worth asking how phones are being used in conjunction with these technologies.

Among the broader uses of the mobile phone, coordination work among the different actors in the fish economy constituted an important category of uses. This was important in fish marketing activities and in fish preservation. Boat owners and fishing crew described (and we saw) how they would call their auctioneers a few minutes before they arrived at the shore to ensure someone was on hand to perform the auctions.²⁷ The ice-seller on the shore called the ice company to order ice based on the fish supply on a given day.²⁸ Wholesale merchants and export agents used their phones to communicate details of the trucks on which they were sending fish to agents at the destination.²⁹ The perishability of fish, of course, was part of what made this coordination work critical.

Mobile phones were also used in conjunction with Garmin GPS units at sea and on shore to gauge

25. "There's *chavittal*, which means the agents join together and reduce the price of the fish," observed two crew members of Kamaluddin's gillnet boat (October 24, 2012). Sreekumar also reports collusion in his accounts of south Kerala (Sreekumar, 2011).

26. Interview with Siraj, a private investor-auctioneer in Chaliyam (October 9, 2012).

27. Kamaluddin, who owns three gillnet units in Chaliyam, told us his boat crew had just called him to say his boat was going to reach shore soon; they had said only five more nautical miles to the shore (October 21, 2012). Shanawaz, a gillnet boat owner and fisher in Chaliyam (October 9, 2012) said, "We call agents when we return for telling them the time of arrival. Otherwise no need to call them."

28. Interview with Arif, an ice-seller, Chaliyam (October 9, 2012).

29. Interview with John, an export agent in Vizhinjam, the south Kerala site we focused on (August 26, 2012).

the location of fishing grounds. The GPS, which most fishing units carry, was used to mark and specify the exact location where fish are found on a given day. Fishers both used these markers themselves at a later date to look for fish and shared them with friends and relatives, a practice also noted by Abraham (2007) and Sreekumar (2011).³⁰ The widespread use of GPS and echo sounder technologies to pinpoint the location of fish and the use of GPS coordinates to precisely share such prime fishing locations with others postdates Jensen's study and is another element of the changing industry. However, it is worth noting that Jensen considers and dismisses the likelihood of such a practice being against fishers' self-interest.³¹

Finally, mobile phones (along with other communication devices) were perceived to be important in times of emergency, as others have also noted (Abraham, 2007; Sreekumar, 2011). Fishers used both phones and wireless sets (the latter were typically installed only on ring-seine boats and trawlers) to contact the shore or other fishers in case of emergencies (such as running out of fuel or a damaged engine). Fishers frequently mentioned the dangers of fishing.³² A Chaliyam fisher relayed a story of being out at sea when his fuel ran out and his eventual rescue following a phone call placed on a satellite phone to a coastguard office. He added, "I have great respect for this device because it saved our life."³³

Using examples from north Kerala, we outlined five primary uses of mobile phones: (1) price information-gathering in combination with (2) arbitrage work (both considered by Jensen), as well as (3) coordination work, (4) fish-finding, and (5) emergency response. We question the singular attention placed on the first two in ICTD, and the pithy statement that commonly circulates in the aid sector and the mass media that "farmers/fishermen use mobile phones to get a better price for their goods." What we heard from fishing industry actors in the field in north Kerala is that there is no single practice that prevails as the most significant or universally valued use of the phone. It is important, we argue, not to mistake the focus and priorities of disciplines (such as the concern in economics for how information availability affects market functioning) for those of target populations. There are opportunities in the ICTD space (perhaps underexplored) to support the underlying needs that these alternate practices reflect.

The varied uses of the phone among these actors are matched by almost as many understandings of "welfare" in their lives. People did not define their well-being or welfare primarily in terms of their income or in terms of optimizing it. Many of them, especially the owners and crew of *vallam* and gillnet boats, and small-scale vendors, spoke instead in terms of managing or coping. They spoke of their physical and mental well-being, sometimes prioritizing that over an increased income (such as the fishers mentioned earlier, who wanted to sell quickly and go home to rest, rather than wait to get the best price). The survival of a fishing unit lost at sea or caught in a storm is, of course, critical to fishers' own long-term welfare and that of their families. Fishers and others in the fishing supply chain spoke also of maintaining relationships with fellow fishers, their auctioneers, or regular buyers, rather than solely of optimizing their incomes (as reflected in practices of sharing fish-finding locations). These practices may very well eventually lead to improved incomes, but over a longer term and in less easily measurable ways. They also lead us to point out how Jensen's definition of the fishers' problem as being one of how "to maximize profits by choosing where to sell their fish" (Jensen, 2007, p. 815) or equating income increases to welfare benefits narrows our understanding of the reality of the fish market.

6. Conclusions

We investigated the conditions underlying Jensen's influential findings regarding mobile phone use among fishers in north Kerala. In examining Jensen's model against the backdrop of these conditions, our claim is not that the model's representation of reality is inadequate because it fails to reproduce every variable and detail of

30. Interview with Susadima, a *vallam* owner and fisher, Vizhinjam (August 26, 2012); conversation with Thomas, a *vallam* crew member, Vizhinjam, (September 6, 2012); conversation with Kabir, a ring-seine share-owner and fisher, Chaliyam (October 25, 2012); conversation with crew members of Kamaluddin's gillnet boat, Chaliyam (October 21, 2012).

31. Jensen notes, "[C]atch is to an extent rival, so those with a good catch have an incentive to lie" (Jensen, 2007, p. 906, in footnote 24).

32. We came across one such tragic loss of a fisher at sea when we visited a village in south Kerala.

33. Conversation with Shanawaz, a gillnet boat owner and fisher, Chaliyam (October 10, 2012).

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the world. Rather, we press onward to question: Why does what is *specifically* missing from the representation of the world in the model matter? We argue that in this case, a parsimonious model (that omits details such as the existence of fishers' cooperatives, the mediation of fish sales by investor-auctioneers, and the structure of investments in the industry) has skewed and narrowed the solution space in particular ways, thereby framing what policy or design implications are likely to be extracted from the study. Our broader concern is to understand the consequences of a single study disproportionately influencing our thinking in a field such as ICTD.

An important way in which Jensen's work narrowed the solution space was through its deployment of broad categories such as "fishermen" or "buyers." These categories concealed considerable diversity in economic and social circumstances. Over time, as mobile phone ownership has increased, diverse ways of using the mobile phone have emerged within these broad groups. In this way, we critique the reliance on broad categories and on aggregates and averages that generalize the needs, positive uses, and outcomes of the relatively more affluent to the whole category. Such a reliance can obscure the potentially different requirements of lower-income subsets of the larger group. The qualitatively distinct uses of the mobile phone by (for example) small vendors, small-scale fishing units, and workers without boat-owning shares were often related to managing risk and vulnerability rather than optimizing efficiency. These uses would suggest a different class of design interventions entirely, ones that seem (so far) to be little attended to in ICTD-related work. To design for and reach such subgroups *directly* (which is ostensibly the aim of much ICTD work) and not through "spillover gains," there is a need to recognize the fundamental differences in approach within the broader categories.

A second example of disciplinary skew from Jensen's work is its considerable emphasis on the power of impersonal information relative to the social basis of information circulation in trading relations. We found that while *information* was by all accounts critically useful to the Kerala fishing industry as a whole, its utility clearly flowed along a baseline of exchange relationships developed among actors in the supply chain. Jensen's findings about information availability, mobile phones, and market efficiency, while intended as a contribution to debates within economics, are regularly enlisted to justify larger policy or technology design decisions and have given credence to widespread but (we would argue) misguided solutions involving impersonal information provision. For example, numerous SMS-based price information systems and services such as Esoko, Nokia Life, and Reuters Market Light, which are now available in many countries, are built on the assumption that information is actionable in isolation. These systems misunderstand the enduring power dynamics of trade and its basis in person-to-person relationships that we found in north Kerala.

Finally, the depiction of the market in Jensen's account as seemingly more open and free than our further investigation revealed has provided weight (in the policy context) to notions of pure technology transfer (absent market regulation or other reforms) and the adequacy of private-sector solutions (the latter Jensen calls out specifically in his conclusion as an implication of his study). However, we show that the systems of auctioning and investment that beach markets relied on were brought about by the efforts of both state and nonstate actors. Fishing regulations and rules were also enacted and implemented by the state. Far from complaints about interference from the state, the fishers we met complained only of how the state was not doing *enough* to police these regulations. On the balance, we find that the fishers' cooperatives and the auctioneering system are one type of solution that was successful by all accounts in enhancing fishers' profits. The introduction of mobile phones was another. In this context, both were necessary to yield the observed improvements in welfare. A representation of a market that does not account for these ways in which it has been regulated has political implications. This is of special concern in ICTD where claims about the empowering qualities of information or of ICTs can make underlying and ongoing political struggles invisible. Yet, these struggles shape the market and the power relations within which ICTs can be effectively put to use. ■

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