Informality and Invisibility: Traditional Technologies as Tools for Collaboration in an Informal Market

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ABSTRACT

This paper explores how actors in local markets in the Global South adapt traditional communication technologies to successfully collaborate in sustaining the markets and their business practices. Drawing on ethnographic observations at a local technology goods market in Bangalore, India, the study details the use of a landline telephone intercom system as the primary tool for business communication in the market. Through analyzing how the intercom system relates to informality and physical space, the paper argues that it bridges the formal with the informal, and helps facilitate informal business practices while also allowing them to remain hidden from the formal regulatory gaze of the state.

Author Keywords

Informal markets, infrastructure, HCI4D, development, Telephone, Intercom

ACM Classification Keywords

H5. m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

This paper explores the technical infrastructure that underlies the organization of local markets in many parts of the Global South. In particular, it looks at the interplay between informal and formal business practices, and how local actors are able to leverage communication technologies such as telephone intercom systems to create efficient ways to collaborate and collectively manage these markets.

Local markets are active sites of economic activity in urban landscapes around the world, catering to the specific needs of low and middle-income customers. The informality of these markets has allowed them to be flexible and offer services that are unavailable in the formal economy but exist as an integral part of everyday life – such as the repair and maintenance of electronic goods. The paper will use

Hart's [22] original definition of the informal economy which referred to the absence of state-imposed regularity on the irregularities of social life. In the absence of state regulation or when states are unable to enforce their regulatory systems on these informal business practices, social regulation [4] becomes the primary means by which business practices are regulated. This social regulation is a result of existing cultural and social structures; the informal economies are subsequently embedded in networks of social relations and social institutions [21] such as gender, caste, ethnicity, etc., and these social ties become the primary means by which these economies self-regulate and function effectively.

The intersection of these informal economies with the forces of globalization has led to what has been termed by development scholars as "globalization from below" [30]. Local actors tapping into the economic potential of globalization has created informal markets across the Global South that offer cheap goods and services that are otherwise inaccessible to a large percentage of the population. The politics of these markets [38] along with the informal entrepreneurial spirit [11] that is found in these spaces have long been studied by researchers. However, what is interesting from a collaborative systems perspective is the technical infrastructure that supports the social organization of these markets.

The paper consequently looks at a trend that is increasingly becoming common in information and communication technology & development (ICTD) and HCI4D literature. Moving away from paternalistic top-down formal technology interventions for communities, instead looking at local community-driven informal deployment of technologies that are tailored to specific geographies and social conditions and needs [12]. Studying this bottom-up adoption of top-down technologies [32] not only captures the innovativeness of informal markets in adapting new and existing technologies but also the nature of socio-technical activity present in informal economic practices. In the process, it also expands collaborative work to the invisible urban spaces that dominate markets in the Global South.

Drawing on ethnographic observations at Sadar Patrappa (or SP) Road, a prominent technology goods market in the city of Bangalore, India, this paper will outline how local actors have been able to use traditional communication technologies to successfully collaborate and maintain the

market for over three decades. SP Road has, over this time, become the primary hub for purchasing and repairing electronic goods in Bangalore. The paper will describe the market ecosystem and the spatial configurations that allow informal activities to remain invisible. It will subsequently analyze the underlying technical infrastructure and specifically look at how the affordances of the traditional landline telephone intercom system support the informal business practices here along with re-shaping space in the market.

RELATED WORK

Space and Informality

Space – both physical and virtual – plays an important role in shaping and facilitating social interaction and coordination [3,16,18,43]. Echoing Lefebvre [29], Dourish [14] has argued that space is socially constituted rather than just being a three-dimensional geometric environment encasing social actions. Spatial configurations are thus intertwined with collective practices and, in recent times, increasingly with information and communication technologies (ICTs) while also continuously being molded by power relations, societal structures, and history. Crucially, physical spaces are made legible and even transformed as people collectively discover new ways of navigating them through their use of ICTs.

This paper primarily focuses on how ICTs are collectively used by actors to reinterpret urban informal spaces and facilitate collaboration. Much of these physical spaces are hidden away from sight at urban markets such as SP Road and in analyzing collaboration in this market, the paper borrows from a corpus of work that focuses on how successful collaborative systems not only ground communication in formal structures but also embrace the informal side of users negotiating articulation [37]. Star and Strauss [41] build upon the interplay between the formal and informal to provide a framework that analyzes work and details the different ways it is rendered 'invisible'. This could be because workers (doing very visible work) become socially invisible or conversely while the workers could be visible, their work becomes embedded in the background. Often, informal work – such as repair and maintenance [25] – that exist outside the formal economy are invisible because either formal indicators are incapable of capturing this work or choose not to value them.

This paper focuses on an alternative but related scenario where informal work is actively hidden by actors from the various offices that the state manifests itself in - such as the regulator, the law, and the tax collector [8]. The informal and formal, however, coexist, and the informal, unbounded by regulations and bureaucratic hurdles, provides much-needed flexibility [45]. The paper will detail the business practices at SP Road, the interplay between the visible formal and the invisible informal, and the role that traditional communication technologies such as telephones play in bridging the formal with the informal, allowing

actors in the market to successfully collaborate and sustain the market.

Innovation, Informality, and ICTs in the Global South

HCI design research has, in recent times, started to recognize alternate spaces of innovation, especially in non-Western settings. For example, studies have highlighted local practices of disassembly, maintenance, repair and reuse in the Global South that significantly extend the lives of devices and technical infrastructures [7,24,25]. These and other studies also show how innovation and technology use is situated within the broader socio-economic structures of everyday life, often intersecting with informal practices. For example, e Silva et al. [40], in the context of Brazilian favelas, discuss how mobile phone appropriation is deeply intertwined with the gray economy that the residents are a part of – their social and economic conditions being mirrored in their mobile phone practices.

Similar studies detail the frugal innovation in low-resource environments [32] along with the agency of communities in finding resourceful and adaptive means to make ICTs fit their everyday lives and practices [31,39]. Here, the practices of adoption, appropriation, and finally the reconfiguration of technologies reposition the users in the processes of innovation and diffusion. This, in effect, renegotiates the inherent power relationships between the providers of technology and the users [2].

Studies on local informal ICT markets catering to low and middle-income consumers highlight the entrepreneurial and creative practices present in these urban spaces. For example, Ilahiane and Sherry [23] describe the enterprise culture in an informal ICT market in Morocco that helps bridge local demand with global ICT markets. The importance of social networks in these markets has also been well documented. Studies on informal mobile phone store ecology in India find that these networks help vendors circumvent environmental constraints [33] while also allowing them to be durable and flexible in their ability to adapt to environmental changes [34].

Relevant to this paper is also how self-organized ICT networks augment offline social and business networks. Electronic community networks maintained by local communities to support their information and communication needs have been around since the 1970s and widely studied in community informatics literature [26]. With respect to the Global South, such networks have been considered as a means to empower marginalized communities and bridge the digital divide [36]. However, these networks have primarily focused on extending low-cost or free internet access to citizens and have usually been initiated by external actors.

The Fixed Telephone and Collaboration

The emergence of communication technologies such as mobile phones has led researchers to look at how mobility and virtual spaces influence social interaction and

collaboration. However, much of the work that studies communication practices has been in the Global North with work in the Global South usually limited to studying the appropriation and use of mobile devices/applications or social media use [46]. Mobile communication has indeed become a common phenomenon in most parts of the Global South, and HCI4D literature has identified ways in which local communities are adopting these technologies to meet their specific needs [27]. For example, Donner [13] finds that mobile phones significantly expand the business networks of micro-entrepreneurs in Kenya and are often used as personal devices.

However, beyond the electronically mediated interactions of mobile devices, there exist complex ecosystems of communication that often include more traditional technologies such as fixed telephones. For example, in an ethnographic study in Mexico, Wang and Brown [44] find that the communication ecosystems in rural landscapes are tailored to the specific geographies and that fixed telephones still play an important role in the communication practices of locals.

The simplicity and (former) ubiquity of fixed telephones have, in the past, led researchers to look at them as a potential platform for CSCW applications [35]. Studies have also suggested that the intermediate levels of media richness and social presence that is afforded by them, might make them better than face-to-face or computer-mediated interactions [9]. As mobile telephony has become more ubiquitous with its numbers greatly exceeding fixed telephone lines, the continued use of the latter in the Global South points to an account of communities leveraging the affordances of technologies that they are familiar with to construct communication ecosystems that suit their unique social and economic needs.

In this paper, I discuss the use of a landline telephone intercom system by local actors at SP Road, Bangalore to collectively organize and manage a technology goods market – facilitating both adversarial collaboration and vertical interdependence between actors. I subsequently analyze how the intercom system relates to the informality and physical space at SP Road along with discussing its role in either creating invisibility or making existing spaces and practices more legible.

DATA AND METHODS

The study was conducted by means of participant observation [1] over 2 months (from June 2015 to July 2015) at SP Road, Bangalore. Ethnographic observations were conducted at various locations in SP Road including the stores and informal service centers. This was supplemented by an exploration of SP Road and just general 'hanging around' [6] to get a higher level view of the activities within SP Road. In addition, the researcher conducted numerous in-situ interviews to clarify understandings with minimum interruption to the ongoing flow of activity. These observations produced a rich picture

of the market, the day-to-day activities of actors in the markets and the infrastructure that supported the functioning of the market.

The observations were supplemented by 13 semi-structured interviews with various actors who were part of the market ecosystem and willing to talk to the researcher - these including vendors, consumers, and law enforcement officials. Interviewed actors were predominantly part of the ICT goods vertical at SP Road. All the individuals interviewed were male – technology goods markets in Bangalore are predominantly male-dominated. Most of the interviews at SP Road were in Hindi, which the vendors belonging to the Marwari community spoke proficiently while interviews with non-Marwaris were primarily in English.

The researcher was born and brought up in Bangalore, India, was aware of the local culture, and could understand many of the languages spoken at the marketplace. However, as an outsider attempting to document activities that were exclusive to only those who were part of the informal market ecosystem, the researcher was treated to high levels of suspicion. Finding people willing to be part of interviews and observations was a significant challenge. Even when participants were willing to talk, they refused permission to be recorded or photographed. Therefore, data was primarily collected through extensive field notes, which were written up daily on return to the lab. Most notes were taken in shorthand on a mobile phone – a ubiquitous device in these markets, unlike paper notebooks which were also looked at with suspicion.

THE SP ROAD MARKET ECOSYSTEM

Sadar Patrappa Road (or SP Road), a crowded 1 km stretch of road adjoining the historical market areas (*or Pettah*), is the primary location for buying and repairing technology goods in the city of Bangalore located in South India. Here, narrow roads intersect the busy main road at regular intervals, with a crowded network of alleys housing the smaller shops in the market. At SP Road, local vendors have kept up with changing technologies for more than three decades and offer a wide spectrum of technology goods that range from relatively low-tech technologies such as water pumps to high-tech technologies such as branded portable computers. The market is renowned for its ability to offer goods at competitive prices and provide technical services unparalleled in the city (and surrounding regions).

The market ecosystem primarily consists of vendors, wholesale distributors, and informal service centers for most technology goods. In addition, there exist service providers such as those who deliver beverages and food to the shops on demand. The foot traffic at SP Road usually consists of low and middle-income customers, along with vendors from outside SP Road who source their goods from here. The recognition of this locality as an important destination for purchasing electronic goods has led to companies like Dell and HP opening their showrooms on

this road – their shiny and clean exteriors, however, are in sharp contrast to the other shops.

Figure 1: The main road at SP Road

In most retail shops, unbranded or local electronic components – or 'compatible' components – are stacked alongside branded components. These are either imported from China or made by local Indian manufacturers and are preferred by price-discerning customers. However, while the range of goods that can be obtained at SP Road is unparalleled in the city, the retail stores on the main roads have conspicuously small inventories. When customers asked for a component that is not in stock, vendors were observed calling wholesale distributors from a landline phone who would then send someone over with the required components. If the customer chose to purchase the component, the transaction was completed otherwise it was sent back to the distributor.

"They are all distributors. For every component, we have multiple distributors. They all have different numbers. We have an intercom here for that." – Assembler 4

The crowded markets of SP Road, where many small vendors jostle with each other on narrow vertical niches, while also keeping up with the rapid obsolescence that accompanies technology goods, lends itself well to the practice of acquiring components on demand. Small inventories are also important for vendors on the main roads because of the high rents of real estate with the consequence that these shops are often very small. This real-time system using the telephone intercom is thus a flexible workaround that allows vendors to combat uncertainties of customer demand while also dealing with limited physical space.

In contrast to the vendors who are visible on the main roads, the wholesale distributors are situated away from the main roads and completely off-limits to customers (often with handwritten signs stuck crudely on closed doors that say the same). Here they pay lesser rents, are relatively anonymous, and are able to keep extensive inventories while sourcing merchandise to vendors.

Away from the main roads, the informal service centers are tucked away well inside building complexes or inside the narrow alleyways that branch out from SP Road. While they do cater to regular customers who find their way to them, they get a large amount of their work from the vendors who send electronic devices to them for configuring or repair, or through touts who roam around the main roads guiding potential new customers to them. For vendors who sell custom-built electronics such as white-box desktop computers, the service centers are where the assembling is done.

Communication between the service centers, wholesale distributors, and vendors is done exclusively through landline telephones which are part of an intercom service that connects all the shops at SP Road, in effect bridging the various actors spatially distributed around the market.

State Actors and SP Road

Besides the economic actors at the market, state actors – such as law enforcement agencies and sales tax officials – also exert significant influence on the SP Road ecosystem. Police raids shape the availability of illegal or gray market goods sold at the market, while many of the business practices are in response to actors finding ways to maximize profits while also satisfying sales tax officials. For example, anti-piracy raids have led to shops no longer selling disks of pirated software; instead pirated software is now only installed by service centers using installations saved on portable hard disks – an activity that can be hidden away quickly.

"Does police ever trouble you in your work?

… We're too small for anyone to care. We mind our own business and do our work." – Service Center 2

Conversations with officials at Forgery & Misappropriation (F&M) division at the City Crime Branch (CCB) – an agency handling intellectual property-related crimes in Bangalore – gave credence to the notion that the state actors do not wish to waste time and resources going after shops that are "just trying to make a living". In the case of CCB, it is primarily motivated by their desire to spend their resources and time catching the larger players in the piracy supply chains – such as those who supply and distribute pirated goods, rather than focusing on shops that only sell them.

There is thus a tense equilibrium at these markets – while the threat of raids hangs in the air, formal actors often choose to turn a blind eye and are thus complicit in ensuring the invisibility of informal economic practices, but this is heavily contingent on actors being discreet about their activities and the profits remaining small.

Space and SP Road

Physical space, in the context of SP Road, is as much a product of historical factors as it is of economic and social factors, with the outline of the traditional market (*Pettah*), established in the 16th century, persisting at the peripheries. Thus, while the goods sold have changed, the markets

continue in the same spatial configurations as they have for centuries. Further, former residential areas have, over time, been converted to market spaces. Tightly packed buildings crowd either side of a deep network of roads with narrow roads intersecting the busy main road at regular intervals along with a constellation of alleys that house the smaller shops. As one moves further from the main roads, there is a transition from the formal to the informal, as informal activities are hidden away from the regulatory gaze of law enforcement agencies and sales tax officials.

Not all shops can be seen from the main roads, and the signs put out by these shops to indicate their location create a crowded disorganized mosaic. Actors that chose to be invisible to customers, such as some of the distributors and service centers, don't bother with signage. The labyrinth of buildings, alleys, and roads do get overwhelming for new customers, who the researcher often observed struggling to retrace their steps.

Figure 2: Narrow alleys that branch from the main road

As previously mentioned, real estate rents are a function of how visible a store is to foot-traffic. Shops on the main road are able to maintain small floor areas by outsourcing technical servicing to the service centers and inventories to the wholesale suppliers. The minimal inventories in shops also hide a significant amount of trade that is instead conducted through the intercom in real time with no paper traces left behind, thus allowing them to partially evade audits by sales tax officials.

The intercom service plays an important role in the business practices in linking the informal activities hidden away from sight with the more formal retailing activities that are actively advertised to the customers. In the next section, the paper

will describe this landline telephone intercom in more depth and discuss how this underlying technical infrastructure allows economic actors at SP Road to communicate and collaborate effectively. Subsequently, it will explicate on how the intercom service relates to informality.

THE INTERCOM SYSTEM AT SP ROAD

The telephone intercom system at SP Road is an EPABX (electronic private automatic branch exchanges) service that is franchised from Bharat Sanchar Nigam Limited, the government-run telecommunications service. It allows commercial establishments to run their own in-house telephony switching systems (referred to as an intercom system) and is independently run by a vendor under the auspices of the Bangalore Electrical Association, an organization that SP Road merchants have set up to ensure the smooth running of the market.

"Everything is a two-wire system, whether you are working with electricals or working with phones. So, it is easy to use. I figured out once I joined the job." – Intercom1

As evidenced by the above quote, the technical simplicity of the telephone intercom service allows for its easy maintenance and use. At the time of this study, the intercom was being maintained by two electricians who had only recently started working at SP Road but had figured how to maintain the system on their own within a few weeks. They also viewed the researcher with great suspicion, taking a photograph of his identification cards using their mobile phone camera and refusing to give permission to take photos of the equipment in the room.

The intercom office that they worked in was on the top floor of the first major building as one enters SP Road with no external signs indicating its presence. It was thus conveniently located with respect to vendors finding them, but still invisible to customers – there was little chance of anyone accidentally stumbling upon them. The office itself was sparse – a small room with the EPAPBX system and an inverter in the scenario that there were power cuts, along with a table with a desktop computer, another table with multiple landline phones, 2 chairs, and a creaking ceiling fan.

The intercom has around 500 active connections at a time but can support a maximum of 1500 connections. It covers almost all shops on the 1 kilometer stretch of SP Road except for the smaller stalls. Getting a line to the intercom service and a four-digit phone number is a prerequisite for anyone who wants to start a major shop at SP Road. He is initially charged a starting advance that is proportional to the size of his shop, ranging from Rs. 2000 (~30 USD) to Rs. 3000 (~45 USD). He is subsequently charged a monthly rent of Rs. 200 (~3 USD).

"No directory or records. We just remember who to call. That we know the numbers of who we need."- Assembler 2

None of the vendors were observed using any directories that listed the intercom phone numbers of the various shops. Once

a shop gets a connection, the 4-digit intercom number has to be subsequently conveyed to all other relevant stores by word-of-mouth along with services that are being offered. This is an important "interaction ritual" [20] that allows new actors to join existing social and business networks. Given the range of technology goods available at the market, this ritual limits the exchange of numbers with only those who matter to a specific technology good (for example, personal computers). It also means that as the market evolves as new technologies and actors replace older ones, the onus is on those who arrive at the market to socially integrate themselves with the existing market.

It is crucial to note here that mobile phones are extremely common at SP Road. Almost all the actors observed by the researcher spent their free time entertaining themselves on their mobile phones – either playing games, watching movies, or listening to music. However, despite the ubiquity of the mobile phone, the intercom continues to remain the primary means of business communication within the market. Mobile phones, on the other hand, were primarily used to communicate with outsiders – either customers or non-SP Road vendors and distributors.

Figure 3: The landline telephone connected to the intercom system

The merchants take great pride in the intercom system and extol its utility and ease where all their important business contacts within the market are just 4-digits away. The intercom has also facilitated the creation of a layer of service providers that cater to all merchants – these include tea-sellers, tiffin shops that provide lunch, and handymen such as electricians.

The intercom system is thus an integral part of the SP Road business community. All major actors, irrespective of their location, are by default connected to the intercom network.

Through personally introducing themselves, sharing the intercom number, and detailing the products and services they offer they become part of the business network that corresponds to their specific technology good. The technical infrastructure subsequently sustains vertical interdependencies in the market and ensures that it runs smoothly.

THE INTERCOM, INFORMALITY, AND COMMUNITY

Informality helps refigure our perceptions of economic activity in the Global South. However, by "fail[ing] to adhere to the established institutional rules" [17], they are often perceived to be illicit by the state. Sociologists Cross and Pena [10] argue for a differentiation between informal and criminal based on the relationships between regulatory mechanisms and the economic activities. Thus, informal markets are regulated by informal or social-institutional means and can, on many occasions, appeal to the state or criminal organizations for assistance, while criminal economies are completely regulated by criminal organizations. They conclude that an informal economy is different from a criminal one not by the nature of activity but rather if they can "negotiate a level of coexistence between legal (state) and extralegal forms of regulation".

At SP Road, the majority of goods sold are legal; while the researcher was on multiple occasions offered a 'cheap' iPhone, these instances were rare and this was corroborated during in-situ interviews with customers. However, some of the services offered, such as jailbreaking imported game consoles or installing pirated software, are not always on the right side of the law. Further, many of the informal business practices at SP Road attempt to evade formal regulations such as sales tax, with one vendor telling the researcher that they feared sales tax officials more than the police.

"As long as we give a bill, everything is legal." – Assembler 4

The practice of giving formal receipts (or bills) draws the line between the formal and informal – and also legal and illegal – in most markets across the Global South. Discrepancies between expected receipts and actual receipts have long been measures of shadow economies [19], and sales tax officials spend considerable efforts in clamping down unreported sales and skimming of receipts.

Purchases of electronic goods are deemed legitimate and under warranty by manufacturers only if the customer can show a receipt as proof of purchase. Vendors at SP Road subsequently provide receipts only when the goods have company warrantees or if the customer explicitly demands them. Goods are usually offered at a lower price in the absence of a receipt. The service centers offer no receipts because most of their services offered are informal and on goods that are usually outside of company warranty.

Crucially, transactions between the vendors and wholesale distributors also happen without any formal contracts. Here, it is important to understand the strong community networks

within the market - the majority of vendors belong to the Marwari community, a successful trading and entrepreneurial community [28] with strong community bonds that dominate trade in this part of the city (among other parts of India). The strong social bonds allow economic relationships to function solely on the basis of trust rather than formal contracts. Thus, a vendor can make a real-time request for a component from a distributor via the intercom phone, and complete the purchase with the customer without having to formally purchase it from the distributor – with the books balanced informally at a later time.

These social bonds are also visible in vendors outsourcing technical work to service centers based primarily on personal connections and who they can trust. During interviews, all vendors refused to disclose the service centers that they outsource their technical work. The service centers are where all informal technical work is done, some of it illegal, for example, the installation of pirated software. In interviews and customer interactions, the vendors stressed that while they could get pirated software installed, it is not them but someone else who would do it. Subsequently, the service centers – who were a phone call away on the intercom, but hidden to outsiders – were reached out to install the pirated software.

As previously mentioned, there are sometimes attempts at disrupting illegal activities through official raids – either by sales tax officials or law enforcement agencies. The larger shops on the main road are of course more susceptible to these raids due to their visibility. To deal with the raids, these shops often bribe local area policemen and leverage insider contacts who can warn them in advance, information that is subsequently conveyed to other shops also via the intercom system.

Intra-community bonds and the Intercom
"The new people who come here, how do they start (a shop)?

They have money with them. They hire people who already know this place, SP Road, and business." – Service Center 1

Besides providing a relatively secure communication line that is completely controlled by the market association and is geographically constrained within SP Road, the intercom also has a deep symbolic value. By default, an actor at SP Road is invisible to the rest. The ritual of getting an intercom line and conveying the number to others in the market is an integral part of getting to know SP Road, the community, and their informal business practices. As seen in the above quote, businessmen who are new to SP Road hire those who have an intimate knowledge of the social networks and practices at SP Road. Leveraging intra-community bonds are crucial in this market and the telephone intercom system is ultimately a technical manifestation of these bonds.

Businesses at SP Road follow an apprenticeship model of training, where new workers – many of them fresh migrants from the village – learn on the job as they work with older, more experienced workers from their own community (and

of often from the same village). Some of the more experienced actors have been working at SP Road for many decades, while most of the younger males who the researcher interviewed had never used a computer before starting work at the market. The traditional landline telephone is subsequently a communication tool that all actors at the market can use with equal ease irrespective of age or technical aptitude.

"We're all interdependent on each other here. (Pointing to chai-walla (or tea-seller)). Even the chai-walla is dependent on us. If customer comes (to us), he gets business, otherwise nothing. This one has 2 to 3 employees who work for him. So this interdependence means that if one person suffers, everyone suffers down the chain." – Service Center 1

The roles of economic actors are clearly defined at SP Road – with wholesale dealers, the vendors, and the service centers occupying different spaces in both the physical market and the business ecosystem. Further, each technology good – for example. mobile phones, personal computers, or electrical appliances amongst others – has its own independent ecosystem that, for the most part, doesn't intersect with other ecosystems. The intercom service is however used by all actors irrespective of what goods or services they sell - the only criteria being that they are physically located at the SP Road market.

While there is vertical interdependence in the market, there is also intense horizontal competition at SP Road that plays an important role in driving prices down. However, despite the competition, vendors were observed helping each other out on numerous occasions – from helping balance account books to getting information about new products. This was true even in the service centers where they exchanged technical information and equipment freely with each other. Social relationships are important at SP Road and it allows for adversarial collaboration where the market is informally regulated by the intra-community bonds.

These intra-community bonds are an important reason why the intercom system has been maintained by the market without any external assistance. As mentioned, social regulation is the primary means of regulating the informal side of the market – consequently, local disputes are handled by the community and the association (Bangalore Electric Association) they have formed rather than law enforcement agencies.

The intercom service directly relates to informality by being both the underlying technical infrastructure that facilitates and a result of the informal institutions that help regulate and shape business activities at SP Road. It helps in connecting the formal side of SP Road (ex. shops on the main road that appear legitimate under the regulatory gaze of the State) to the informal side (ex. informal contracts of goods and services that exist without paper trails). In the process, it anonymously connects the entire community and helps in partitioning it through the sharing of intercom numbers.

DISCUSSION

The agglomeration of vendors, wholesale distributors, and service centers dealing with a variety of technology goods create a rich and complex market ecosystem at SP Road. Here, the vertical interdependencies are a result of the division of labor that manifests itself spatially and is concurrently distributed between the formal and informal. The social and technical infrastructure at the market plays an important role in allowing this interplay between the formal and informal to exist.

However, it is the informal business practices, sometimes bordering on the illegal, that have allowed SP Road to remain competitive against formal markets in the city while also revolutionizing access of low and middle-income populations to the flows of economic and technological modernity. Through providing goods at costs lower than anywhere else in the city along with creating an alternative economy of refurbished, out-of-warranty, and 'compatible' technologies they substantially expand the reach of the technology goods market.

Much of the markets in the global South are invisible as local actors find ways to avoid the panoptic gaze of a Weberian state that seeks to regulate and order. That these invisible spaces might be overlooked sites of local innovation has been studied in recent times by CSCW and HCI researchers [25]. The paper extends this to also look at the underlying technical infrastructure that facilitates this invisibility while also selectively making it legible to those within the informal business networks.

Invisibility and Technical Infrastructure

Researchers have argued about the role that communication systems can play in dis-embedding invisible work and hidden actors [41]. Here, the paper stresses that it is not always beneficial for invisible work to be made visible or explicit. This idea is certainly not new to collaborative work – previous research [5] has pointed out the tensions that accompany the disruption of informal and invisible communication. Centeno and Portes [8] discuss how the most effective tool of informal entrepreneurs is not to take on the state but instead withdraw information from it. In the case of local markets in the Global South that thrive on their ability to avoid and find informal workarounds around formal institutions, making themselves invisible from the regulatory gaze allows them to exist and function unmonitored (and untaxed) in the interstices of the formal economy. These workarounds, often bordering on the illegal, encode rich local knowledge about the market and its economic, social, and cultural practices. As mentioned before, in the absence of formal regulations such as the law, their practices are instead regulated by informal regulations that are a result of economic actors being embedded in stable closely-knit networks of communities.

At SP Road, the technical infrastructure constituting the landline telephone intercom – a simple easy-to-maintain low-cost secured communication system – underlies the formation, growth, and continuation of these informal business networks along with facilitating informal business activities. Unlike mobile phones – which have replaced landlines as the primary mode of communication – the intercom system is geographically constrained, and solely built and maintained to support business transactions in the market. Importantly, it flattens out physical space, in effect, transforming the complex labyrinth of roads, alleys, and building complexes into 4-digit telephone numbers. With no telephone directories, informal actors can choose who they wish to be visible to through personally introducing themselves while the default condition is being invisible. This is an important function of the intercom system as the act of becoming visible allows an actor the opportunity to officially introduce themselves and the services they offer to the specific technology goods vertical within the business community. While this introduction could be done through mobile phone numbers too, the intercom system provides an extra layer of privacy by making the phones invisible to the outside world - only those who physically have a shop at SP Road can call the number. There are also no physical traces such as call logs or records. Lastly, the short phone numbers allow them to easily remembered.

Local Technology Use, Informality, and Cooperation

The successful use of the telephone intercom as the default primary communication system at SP Road for more than 3 decades show how communities localize technology and create robust systems that facilitate collaboration in local markets. Further, the continued use of the traditional landline telephone over the more ubiquitous and high-tech mobile phone indicates that there are affordances offered by this technology that could inform the design of cooperative systems.

A key affordance is the relative simplicity of a landline intercom system – both the landline instrument and the technical backend. The landline instrument is limited in functionality and this helps formalize its role as solely a business tool. While actors used mobile phones for other purposes such as playing games, watching movies, listening to music or making conversation, the landline phone was limited to only business communication. In a community that is wary of outsiders, the intercom system is a community-driven indigenous communication system that leverages existing public telecommunication infrastructure to create a private channel that facilitates adversarial collaboration – its simplicity allowing its continual maintenance solely through the efforts of the community.

There is much to learn from informal organizational structures that exist in the Global South, especially how local merchants create order and collaborate without having to resort into formal institutions. Actors at SP Road join the communication network solely due to their need to be part of the community. From a collaborative systems context, this study shows how communities adapt technologies in ways that informally facilitate cooperation. Specifically, it opens

the possibilities of understanding if the affordances that low-tech technologies offer can be leveraged to create communication systems that help local communities collaborate and self-organize around their everyday practices.

This is especially important if we shift our gaze to informal communities that span the Global South who are not only resource-constrained but also functioning in unique political, social and physical environments. In such contexts, studying the complex ecosystem of existing communication devices and specifically studying how local communities are using them can inform the design of collaborative systems that can better support existing social and economic practices.

Technology Appropriation and Control
Globalization has led to the diffusion of ICTs around the world. Local actors have not just adopted these technologies, but also appropriated and reconfigured them – transitioning from simply embedding them in existing social and economic practices to personalizing these technologies and creating new practices around them. These processes of appropriation have also been accompanied by efforts by users aimed at gaining greater control of the technologies – shifting the locus of control from those who provide to those who use. In the case of SP Road, the intercom system, while leased from the state, has been re-purposed as a business tool that the community controls, is proud of, and is used to keep their economic activities discreet.

Tensions between the formal and informal often manifest themselves as negotiations and contestations of power. Many of the business practices at SP Road are thus shaped around efforts at self-provision - the community finding ways to remain competitive against formal retail markets through leveraging social capital effectively. The creation and subsequent maintenance of the intercom system are the results of such a collective social goal where local actors self-organize and exert control over the market infrastructure.

Implications
The future of HCI research in the Global South is contingent on our ability to understand local needs and ways of technology appropriation. However, there is a definite lack of systematic historical data about the informal spaces that dot the social and economic landscape of the Global South. Invisible from formal indicators by their very nature, studying them would require qualitative research that can shine a light on the "thick descriptions" of everyday practices.

The current study shows evidence of a single local reconfiguration of an ICT system to meet the unique requirements of this specific business community at SP Road, Bangalore. These will differ in other informal markets with their own unique sets of environmental constraints, cultures, and everyday practices. However, the case presented in this paper does highlight how the success of informal economic practices is dependent on the ability of

actors to control their visibility – both from the state and other actors.

The design of technical systems often overlooks the necessity of obfuscation in everyday practices. Suchman [42] argues that there are trade-offs in making work visible – for example, while visibility can increase accountability and legitimize work, it can also create new opportunities for surveillance and control. Further, for work that is otherwise contained in naturally-occurring everyday practices – historical, and contextual – the act of making them more explicit can increase transaction costs. For example, the just-in-time nature of supplier-retailer relationships at SP Road depends on local reputation and built up social capital that formal contracts cannot replicate with equal efficiency.

Thus, when studying ecosystems, researchers need to be aware of the constellation of visible and invisible practices – many intertwined with each other. This paper emphasizes Star and Strauss's [41] observation that if systems don't take into consideration the relationships between visible and invisible work, the already marginalized are the ones who inevitably suffer. While efficiency and accountability are important criteria in assessing if certain practices should be made visible (or conversely made invisible), it is important to consider questions of equity and power relationships. For example, would giving an actor greater control over their visibility help empower them or would it reinforce practices that are socially undesirable. This is particularly important when working with informal spaces, where the lines between the legal and illegal often blur. Designed systems need to be particularly careful that they do not restrict the innovation that flows in these spaces through disrupting existing practices by either attempting to make work more visible/invisible or withdrawing the agency of actors to switch their visibility.

In line with Dourish [15], I also want to reinforce the notion of local actors and communities as designers, no longer looking at them as passive users of existing technologies but instead as design actors that are able to reconfigure old and new technologies to meet their unique needs. Informal public spaces have always been contentious – often looked upon as threats to existing order, and as complex sites of negotiation and conflict where the informal finds ways to resist the formal. From an HCI perspective, these sites and their ability to create their own informal design solutions allow us to question the role and place of 'the designer' and the inherent tensions that might accompany any design interventions that seeks to introduce formalized systems to these self-regulated informal spaces.

CONCLUSION
Over the last few decades, local informal networks of economic and social practices across the Global South are increasingly intersecting processes of globalization to create new markets that play an important role in broadening access to goods of technological (and often cultural) modernity. The strength of the informal has always been its ability to

navigate local social, economic and physical spaces. Identifying, analyzing and supporting collaboration in informal settings thus provide us with a practical understanding of how local actors negotiate these informal spaces together as a community. Further, studying how these communities are leveraging new and existing technologies to self-organize and collaborate - while at the same time being invisible to actively avoid formal regulations, shows how the design of collaborative systems can organically unfold in these informal spaces. It also offers important lessons on the ability of actors, driven by local needs and community structures, to reconfigure technologies and create locally appropriate self-governing collaborative platforms.

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