Supporting the Information Needs of Mobile Microentrepreneurs in the Developing World: The Case of Indonesian Food Cart Vendors

Rahmad Dawood, Steven J. Jackson, and Jude Yew

***Abstract*—This paper describes an ongoing research project exploring the business practices of mobile entrepreneurs, specifically mobile food vendors, and the potential use of location aware and mobile phone-based application to support their information needs. Mobile food vendors are a ubiquitous phenomenon in the developing world and can be seen hawking their wares in carts, bicycles, or motorcycles. In this paper we report findings from 28 interviews around business practices, challenges, personal histories, and economic wellbeing among mobile food vendors and 10 of their customers from five major Indonesian cities. Based on these findings, we point to characteristics and features of a mobile phone-based application that will enable these vendors to advertise their current location, accept orders from customers, enable customers' recommendation of vendors, and inform fellow vendors of various special events.**

***Index Terms*—ICT4D, mobile phones, mobile food vendors, microentrepreneurs, ethnography, system analysis and design.**

I. Introduction

In developing countries, the majority of the poor work in the informal sector, the so-called shadow economy. While precise estimates vary, studies have shown that this shadow economy has an enormous impact and contributes substantially to formal economic activity, employment, and economic wellbeing in large parts of the developing world [40]. Schneider and Klingmair estimate this contribution at around 38% of GDP for transition economies and 41% of GDP for developing countries [35]. The International Labor Organization also estimates that between 13% to 58% of developing countries' non-agriculture GDP, and 36% to 93% of non-agricultural employment, comes from the informal sector [22]. Within the sector, microentrepreneurs account for a large portion of both overall economic activities and employment. For example it is estimated that in 2007 Indonesia had 47,702,310 microenterprises that provided jobs for 77,061,669 people, representing 81.7% of all employed workers at the time [8]. Despite this scale, microenterprise based livelihoods show distinct forms of vulnerability: inadequate or deeply uneven income streams, low productivity, and difficult working conditions [23]. For marginal, transitional, or displaced populations, microenterprise may provide important but problematic livelihoods of last resort. Thus, design and policy interventions targeting microenterprise represent one good approach to tackling issues of poverty and marginality in developing countries.

Fig. 1. Mobile food vendors in Indonesia peddling their trade.

In this project we focus on one type of microentrepreneur[1]: mobile food vendors. This focus was motivated by three basic considerations. First, these vendors are very common in developing countries and, while formal statistics in this area are weak, they can be seen along major streets, residential areas, schools, and office complexes offering various types of food and snacks (see Fig. 1). Moreover, research also suggests that most of these vendors resort to this line of work because

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Rahmad Dawood is a Ph.D. student in the School of Information, Unviersity of Michigan, Ann Arbor, MI, 48105, USA (Phone: 734-647-5443; fax: 734-647-8048; e-mail: rahmadd@umich.edu).

Steven J. Jackson is an Assistant Professor in the School of Information, Unviersity of Michigan, Ann Arbor, MI, 48105, USA (e-mail: sjackso@umich.edu).

Jude Yew is a Ph.d. candidate in the School of Information, University of Michigan, Ann Arbor, MI, 48105, USA (e-mail: jyew@umich.edu).

[1]We adopted the Indonesian legal definition for microentrepreneurs: businesses having a maximum net asset, excluding land or building, of Rp. 50,000,000 ($5,555) and a maximum yearly income of Rp. 300.000.000 ($33,333) [Act No 20 Year 2008 on Micro, Small, and Medium Business (*UU No 20 Tahun 2008 tentang Usah Mikro, Kecil, dan Menengah*): verse 1 of article 6 in chapter IV]; in practice all food vendors in our study fall far below the maximum income cap cited here.

they have no other means to earn a living for their family [17][34]. Second, both previous studies [3][18][28][40] and our own preliminary findings show that the incomes these mobile vendors generate are relatively small, vulnerable, and highly variable from day to day. Their ability to conduct business is heavily dependent on the vendor's health, the day's weather conditions, geographic constraints related to legal and social norms on where they can and cannot sell, and the mobile nature of the work. Such conditions create notably uneven and fragile income streams, limiting the sustainability of livelihoods in the sector. Third, due to the mobility of these vendors they have specific location, ordering, and reputational needs to sustain their business. We believe that real-time location and customer information can play an important role in meeting these needs.

In this paper we report early findings from an ongoing project to study and support the information needs of mobile food vendors in Indonesia. We conducted 7 preliminary interviews and 21 full interviews to understand the business practices and information needs of Indonesian mobile food vendors. From this initial ethnographic work we point to characteristics and features of a mobile phone-based application that can support these needs. Our proposed application delivers various kinds of information that these mobile microentrepreneurs can use to better operate their business, better manage their customers, as well as make better and timelier decisions about their route. Such changes may help to both increase and stabilize daily earnings, leading to more productive and sustainable livelihoods in the sector.

Our work contributes to the growing ICT4D literature by casting new light on the working and living conditions of mobile microentrepreneurs in Southeast Asia, identifying core information needs of their business, expanding understanding of current mobile phone use patterns amongst mobile microentrepreneurs, and identifying new ways to leverage mobile technologies to support lives and livelihoods in the sector. Our predominantly urban focus also helps to correct the subtle but important rural bias that has tended to characterize design-focused ICT4D work to date.

II. BACKGROUND

For the last two decades most international aid and development agencies have implemented programs or research targeting microentrepreneurs in developing countries, for example: UNDP's Private Sector strategy[2], IDRC's Private Sector Development project[3], and USAID's Microenterprise Development program[4]. Such programs typically treat microentrepreneurs as an undifferentiated group and center on three major aspects: providing financial support for microenterprises through various financing (including microfinance) initiatives; building the business capacity of the microentrepreneurs through training as well as mentoring; and promoting structural change in local markets through a variety of macroeconomic and policy initiatives. Beyond generalized mentoring programs, however, there has been a surprising lack of research or programming – and virtually no design-based work – aimed at supporting the information needs and basic microeconomic functioning of individual microenterprises in developing countries. This failure stems in part from the informal nature of ICT4D work, which stymies more 'official' attempts at intervention. It may also reflect logistical difficulties in implementing micro level programs that take into consideration the diverse types and large population of microenterprises that are actively operating in a specific region. But this complexity also points to a possible approach in developing and implementing such programs by focusing on specific type of microentrepreneurs and at particular geographic regions.

An interesting emergent pattern among microentrepreneurs has been their increasing use of mobile phones to support core business transactions – a phenomenon largely facilitated by the growing affordability and availability of mobile phones and services in developing countries. Previous studies have shown that mobile phone usage by microentrepreneurs can affect price variability of the products and markets they sell in [2][4][25], the role that intermediaries play in their business [24], the ways they acquire and retain customers [14][15], their transportation costs [19][24], and their level of overall productivity and market participation [32]. Most of these studies have focused on fixed and permanently located businesses and/or have been situated in Africa or South Asia. In contrast, the story of phone use and business practice among mobile microentrepreneurs in Southeast Asia has gone basically unstudied.

Beyond ICT and development, the social impact of mobile and location aware systems has received extensive attention within the ubiquitous computing and wider human-computer interaction (HCI) fields, where a large and growing number of projects have sought to leverage the location aware properties of GSM networks. A prominent line of work here centers on vehicles, with location aware technologies deployed to manage public transit systems (see for example [6][7]), coordinate use of corporate vehicles (see for example [13][39]), or monitor traffic of personal vehicles (see for example [21][31]). Another stream of research addresses more personally or socially focused applications, for example: the use of location aware applications to supplement online social network systems (see for example [9][27][41]); to support social games like geo-caching (see for example [33]); to enhance the urban experience (see for example [10]); or to deliver location targeted information for tourism or promotional purposes (see for example [1][12][36]). We believe in general that these 'Northern' focused efforts represent promising lines of research that may provide important examples and lessons for developmentally focused design efforts. But adapting these systems to the developing world's digital environment will present significant design and implementation challenge. Besides those presented by previous authors [11][38], we note here in the Indonesian

[2] http://www.undp.org/poverty/focus_private_sector.shtml
[3] http://idrc.ca/en/ev-125000-201-1-DO_TOPIC.html
[4] http://www.usaid.gov/our_work/economic_growth_and_trade/micro/index.html

context the limited availability of wireless broadband connectivity like 3G or LTE (as opposed to simple SMS or GPRS); the high prices of high-end devices like smart phones and PDAs making them widely unaffordable to general users (and almost all of the marginal populations in ICT4D work); the continuing high price of monthly service plans versus the more popular pre-paid service models; and the still limited understanding of privacy issues, concerns, and basic information needs of these user groups and communities. The preliminary ethnographic work presented here is intended to begin to fill that gap.

III. Methods

A. Site

Our initial findings draw on interviews with food cart vendors in five different Indonesian cities: Jakarta, Surabaya, Medan, Jogyakarta, and Banda Aceh. The first three represent the largest cities in the country, while the last two are provincial capitals and meant to be representative of medium size towns in Indonesia. All five cities are located either on the island of Java or Sumatra, the westernmost islands in the country and home to nearly 80% of the Indonesian population. Because Indonesia is a very diverse country with 17,508 islands[5] and populated by over 400 ethnic groups[6], to find common features among this diversity we decided to conduct the research over a large geographic location rather than focusing on one specific location.

B. Interviewers and the Interview Process

Because of the large geographical range of our study, to conduct our interviews, we recruited interviewers who resided in our target cities. These interviewers are known to the researchers and associated with the local university in these cities, thus we were able to judge their ability to conduct simple interviews. We provided our interviewers with a semi-structured interview schedule, in Indonesian, containing a list of open-ended questions pertaining to route information, working hours, business ownership, motivation in entering this line of work, customers, source of incomes, mobile phone ownership and usage patterns, and vendors' organization. We also provided guidelines on how to approach and interview the mobile food vendors, including study consent procedures. Prior to conducting the interviews, we walked through the interview schedule with each interviewer, explained to them our expectations for each question and the broader aims of the study, and answered any inquiries that they might have.

The interviews themselves were digitally recorded using the interviewer's personal mobile phone. We also instructed the interviewers to ask for permission to take several pictures of the mobile food vendors while they were working. Upon completion of each interview, the interviewers would then submit to us the digital recording and pictures. If there were questions or parts of the recording that were not clear we would immediately follow up these issues with the respective interviewer. In a small number of cases, follow-up interviews with the same vendors were conducted, and the results were similarly transmitted back to us.

The interviewers were instructed to approach mobile food vendors that they were familiar with, whom they have previously bought from, and those that regularly passed through their house or office. We believe that this familiarity aspect is crucial for the vendors to be willing and openly talk to our interviewers as well as truthfully divulge the needed information. In total, 7 preliminary interviews and 21 full interviews were conducted by our interviewers and a summary of the vendors can be seen in Table 1. To further verify our findings, we also conducted several interviews with customers of selected vendors that we thought might be beneficial.

C. Data Analysis

Because all of the interviews were conducted in Indonesian, one of the researcher, who is a native speaker of the language, went over all of the interview recordings and took extensive notes in English. These English notes were later reviewed, coded, and analyzed together by the research team. If there were particular aspects of the notes that were not clear, the original recordings were consulted and if needed follow up questions would be posed to the respective interviewer where they would return to the vendors for further clarification.

IV. Results

A summary of the mobile food vendors that participated in our study can be seen at Table 1. In general we identified three general themes that characterized and sometimes distinguished these vendors and their businesses: the demographic characteristics of these vendors, their business practices, and the information needs of their business.

A. Demographic Characteristics

The vendor's age varies dramatically, from 25 to 60 years old. There were several vendors who just started out in this line of work, for example a *bakso* (a kind of noodle and meatball soup) seller in Banda Aceh who began selling on his own for the last six months, after being an apprentice to his uncle who also sells *bakso* in Banda Aceh: *"Previously I was working for someone else [selling bakso], but I've been working on my own for six months now."* But the majority of them have been peddling food in the streets for years; for example, a 60 year old *bakmi* (a type of fried noodle) seller from Yogyakarta has been peddling the same food for over two decades; *"After I graduated from school, I tried to become a police officer but was not accepted and started selling bakmi. It has been almost 25 years now."*

Significantly, all but one vendor among our sample were urban migrants - individuals - who had migrated to the city from their respective villages (and in some cases other regions in the country) in the hope of finding a better live for themselves and for their family. *"[I moved to Surabaya] to*

[5] http://indonesia.go.id/id/index.php?option=com_content&task=view&id=112&Itemid=1722

[6] http://id.wikipedia.org/wiki/Suku-suku_di_Indonesia

find additional income to pay for my child's education and working as a farm laborer was not enough" noted one fried rice seller in Surabaya. The sole exception in our sample was a *bakmi* seller from Yogyakarta who came from a village just bordering the city and was a short distance from a big local university there, Universitas Gajah Mada (UGM), which is his main selling area.

TABLE 1
SUMMARY OF VENDORS INTERVIEWED

City	Jakartar: 2 vendors Surabaya: 5 vendors Medan: 6 vendors Jogyakarta: 6 vendors Banda Aceh: 2 vendors
Age	25 – 60 years old
Urban migrant	Yes: 20 vendors No: 1 vendor
Highest level of education	Up to elementary school or equivalent: 9 vendors Middle school or equivalent: 3 vendors High school or equivalent: 3 vendors No answer: 6 vendors
Gender	Female: 2 vendors Male: 19 vendors
Daily travel distance	5km – 12km
Mode of transportation	Walk: 13 vendors Bicycle: 5 vendors Motorcycle:3 vendors
Mobility	Mobile with long range: 16 vendors Mobile with short range: 2 vendors Semi-mobile: 3 vendors
Average daily selling hours	6 – 12 hours
Daily net income[a]	Rp. 20,000 – Rp. 100,000 ($2.22 – $11.11)
Business ownership	Self/family own: 17 vendors Outsourced distribution: 3 vendors Franchise: 2 vendor
Food preparation	Cooked and packaged at home: 2 vendors Cooked at home: 7 vendors Cook on site: 12 vendors
Mobile phone service	Prepaid: 16 vendors Do not own: 5 vendors

The vendors' education level was relatively low, but all had at least some formal education. Here, nine vendors attended some type of elementary level education and, in fact, two of them did not even graduate. Since the schools that these vendors went to were non-vocational and general schools this resulted in them not having the necessary skills needed to pursue other lines of work and pushed them to peddle food on the city street as the only means for them to earn a living. *"My education was not that high, only up to middle school, my parents did not have money to pay [to continue my education]. I don't know what else to do except this"* commented a *soto* (chicken soup) seller from Jogyakarta.

Education level is a good predictor on whether these vendors would immediately start this line of work upon ending their schooling or would previously have some permanent job. Vendors with very low education levels, either elementary or junior high school, would immediately started selling while vocational schools graduate would at first be employed at some business and would resort to vending when they were let go from their employment and could not find a replacement job. We speculate this is because vocational school graduates have immediate skills that they can sell to employers while lower educated vendors do not have this option and would have to find a living on their own. For example: FA a *soto* seller in Surabaya, who graduated from a vocational school in Lamongan majoring in production machinery, prior to food vending worked at a furniture factory and was let go after his factory lost business in the wake of the 1997 Asian Financial crisis. Unable to find a new job, he resorted to selling *soto* a business that was already familiar to him since he frequently helped his father back in his village who is also a *soto* seller.

While 19 of the 21 participants in our in-depth interviews were male, we believe this under-represents female involvement in the sector. Here, six of the married vendors stated that their partner was also working and in fact three of them were also mobile food vendors selling similar types of food. *"[My wife also] sells sate but by carrying it on top of her head"* commented one *sate* seller from Yogyakarta. In addition, non working wives often acted as invisible employees of the business; aiding their husband in buying supplies, preparing materials, and cooking if needed. SM a *bakwan* (almost similar dish as bakso but without the noodle) seller in Surabaya stated that he once sold *gado-gado* (a type of salad) and received a very modest income from it but because he was alone in Surabaya with his wife back in his village, he couldn't maintain the stamina needed to sustain the business (buying supplies, food preparation, and street vending) and decided to switch to selling *bakwan* instead. While for female food vendors, there would be a difference in the food that male and female vendors would sell as well as the way these foods are sold. *Jamu* (a traditional herbal drink) sellers tend to be female because they mostly catered to female buyers. Because of the perceived physical strength needed, women would not be pushing big carts thus would not be seen selling food that would require large carts like: *mie pangsit*, *lontong balap*, or *gado-gado*. These large carts are needed for these types of food because of the large number of items loaded on the cart needed to make the meal.

B. Business Characteristics

Despite the mobile character of their business, the geographical reach of the vendors we studied was relatively limited, ranging from 5km to 12km on a typical day. The main determinant here seemed to be their mode of transportation. A majority walked, physically carrying their goods or pushing a cart, but there were some vendors that used bicycles or even motorcycles to peddle their trade, which usually were attached to their cart (see Fig. 1 for illustration).

The vendors we studied also showed little variability in route; once they had identified a route, they tended to stick to it, with two exceptions. The first is when they were not able sell off their stock by the end of their normal working hours and had to extend their typical range to sell off their remaining food. *"I leave my house around 6:30am in the morning.*

[Return home] if not that many customers can be as late as 5pm or 6pm. The earliest would be 10am or 11am in the morning" noted a bread seller in Banda Aceh. The second, discussed later in this section, occurred when there were special events where the vendors were able to permanently situate their business for that day. The accounts offered by the vendors suggest that this relative fixation of route reflects strategies of risk aversion and the vulnerable nature of their income stream. As described in the interviews, once vendors identified a modestly profitable route able to sustain their business, they tended to cease exploration of new routes, which, while posing possibilities of higher income, could also pose risks of failure. As vendors often relied on one day's earnings to purchase supplies for the next, such failures could cascade in ways that produced long-term declines in income with potentially severe economic consequences.

Beyond route length, we also discovered three general patterns or strategies of mobility among the vendors we studied. The first was to establish a single route covering the widest possible area they could physically reach. This range seemed to be around 10km to 12km per day. The second was to define a shorter route that would be circled more than once in the day. Vendors in Jakarta reported circling their route three or more times in the hope of not missing any customers. *"We don't circle two or three times [a day], if we still have food we will keep on circling our route"* noted one fried rice seller in Jakarta. A third pattern was a form of stochastic mobility, where vendors would move to several locations over the course of their day, stopping at each for 30 minutes to an hour before packing up and moving to the next. This was particularly the case for the sate vendors in our study, who would pause to cook and sell several times over the course of the day.

Contrary to our initial intuition, the vendors we studied did not express any major problems with local city or security officials – a fact somewhat at odds with the reported experiences of squatters and other street business vendors in Indonesia, who have periodically been expelled or harassed by city officials. We believe this may be due to the mobile nature of their business. Expulsions tend to occur to vendors who are illegally creating shops in unauthorized areas thus potentially blocking traffic and producing congestions. The fact that the vendors we studied tend not to remain in any single place for long seems to have largely exempted them from interventions from city officials. There were however some complaints from vendors and their customers on spatial restrictions imposed by other kinds of local authorities; for example, a regular customer of a *mie rebus* (a type of noodle soup) seller in Medan stated that *"The security guards in my [residential] complex select who can enter the complex, for security reason."* Contrary to initial expectations (based on our knowledge of other street-level industries like cigarette sellers and *becak* (pedi-cab) drivers), no vendors reported being constrained in their routes by gangs, associations, or other forms of informal local power structures.

The working hours of these vendors were typically long and varied depending on the food they were peddling and its typical hours of consumption. For example, *bakso* are usually consumed at lunch or dinner and rarely eaten for breakfast; as a consequence all three *bakso* sellers that we interviewed (in three different cities) reported that the earliest time they would start selling would be 10am, just in time to catch the lunch crowd. It should also be noted that the selling hours of these vendors represented in some cases a mere fraction of the time allocated to their work; depending on food type, vendors often spent considerable time and effort on buying supplies and food preparation. As one *lontong balap* (a type of rice, nut and bean curd soup) seller from Surabaya reported, *"I start selling around 8am but before that I need to prepare the vegetables, pickup the main supplies from my boss, clean my cart, wash the dishes, and pickup ice and coconut water. I start working after waking up at 4:30am."*

Even though these vendors are working long hours and exerting considerable physical efforts, their daily incomes are relatively low. The majority of the sellers reported making between Rp. 20,000 to Rp. 50,000 (approx. $2.22[7] to $5.56) a day, just equal to the government-set regional minimum wage rate. But some of the vendors do make a considerable amount, at least by self report. Six of our vendors indicated they can make up to Rp. 100,000 ($11.11) a day, a figure comparable to the starting salary of middle class public servants in Indonesia. We noticed that the high earning vendors were all long time sellers who had worked their business for at least six years.

Moreover, the size of the daily income that these vendors would receive was not consistent and would vary from day to day. As one *kue leker* seller in Surabaya stated *"My daily income is unpredictable, if I'm lucky I can make a little extra."* All of the vendors we interviewed pointed toward this variability on their expected daily income, as also can be noted on the wide range for responses when asked about the size of their daily income. We perceived that the major factors that affect this income variability are: the seasonal characteristic of the vendor's route for example areas that are dominated by university students would tend to be empty during school breaks; the day's weather where it would cut short the vendor's normal route length and reduce the number of potential customers on the streets or that would be able to hear the vendor's signal; and the vendor's health that would constrain on the distance they can reach as well as their ability to even sell on that day.

Due to their variability and low daily earnings, several vendors reported relying on other sources of income to supplement their food cart earnings. There were three ways this was carried out: the first was having their partner also work and earn a living, which range from also selling food or working from home by accepting laundries and sewing orders. Second, many vendors took additional part-time or occasional jobs to supplement household income. For example, the *bakso* seller from Yogyakarta also managed a private student dormitory, which, in addition to income, provided him and his family a place to live without having to pay rent. Third, as most of these vendors were urban migrants, many held a field

[7] The exchange rate used in this paper is: $1 = Rp. 9,000.-

or plot of land back in their village which they returned to tend when planting season arrived. In some cases, this continued to contribute significant portions of overall income; as explained by one vendor, *"back home I attend my rice field, and when planting season is over I return here [Surabaya]. The income from my rice field is much higher than what I'm getting here… [selling] is just my side income."*

Pertaining to the ownership of the business, we also discovered that not all of these vendors wholly own the business; some of them were just acting as distributor for other well established sellers, which might be big corporations or just other small scale but more established food vendors. For example one vendor we interviewed in Jakarta was peddling Walls Ice Cream, a brand owned by Unilever a multinational conglomerate that specializes in consumer goods. Another example is the *lontong balap* seller, which will be profiled later, who is one of several sellers that his boss employs to sell his production of *lontong balap*. We suspect that this later business model might be the next progression of the single owner mobile food vending business, where if the vendor is successful enough and wanted to expand his business then that vendor would need to recruit more sellers to cover more areas to peddle the vendor's product. Moreover, this is not the only occurrence of this business model, there were two other instances that we identified in our study: one for selling *sate* in Medan and the other for selling bread in Banda Aceh. A more sophisticated version of this would be to create a franchise model for this type of business, we also saw one example of this where a vendor was one of three sellers for a new franchise that is trying to sell a new type of food, which is a mixture of fried cassava and mushrooms.

C. Vendors' Profiles

Below we portray the profiles of three sellers that, in general, are representative of the mobile food vendors that we encountered in our study.

1) SU a Pecal Seller from Medan

SU has been selling *pecal* in Medan since November 1989 when her husband passed away. She quit her job as a domestic helper, because it was not earning enough for her to sustain the livelihood of her family, and started selling *pecal*. Food vending is now her main source of income and she owns the business herself.

SU starts peddling her food around 3.30pm and returns home around 7pm. Her daily net income is around Rp 30,000 to Rp. 50,000 ($3.33 to $5.56), which translates into Rp. 750,000 to Rp. 1,250,000 ($83.33 to $138.89) per month. This monthly earning is about the equivalent of the region (Medan) minimum wage of around Rp 1 million ($111.11) per month.

The length of SU's route is around 5km and most of her customers are housewives in residential areas. This customer base is in part due to the time she starts selling and the type of food she is peddling where selling around 3.30pm will not be targeting the lunch crowd and *pecal* is not typically a snack or side dish and one would tend to eat it as a main course. Thus people buying the dish during that time will tend to eat it for dinner. Also during these hours residential areas would consist of non-working housewives.

SU stated that she has not encountered any major difficulties in conducting her business. But the two biggest complications to her business are her health condition and the weather. If she is sick, she would not be able to work, not working will mean no income for her for that day, no income will also translate into no initial capital that is needed to purchase needed supplies to start selling again when she gets well. While for the weather it can further complicate matters: for that day she would have bought all the supplies needed by her business, if it rains then she wouldn't be able to sell her trade, resulting in the supplies being wasted because it cannot be stored and sold on her next selling day.

SU doesn't use a mobile phone because she can't see that well but her son has one and she does give out her son's mobile phone number to her regular customers. Several customers would call her son's mobile phone and place an order for her, this typically would be for special occasions that the customer might have and usually they would request the food to be delivered to their residence on specific time.

2) GU a Soto Seller from Jogyakarta

GU started selling *soto* five years ago after moving back to Java from Sumatera where worked as a plantation laborer. Compared to his previous occupation, GU reports liking his current occupation because of its independent nature where no one is ordering and telling him what to do. GU's older brother introduced him to this line of work and initially taught him how to make as well as sell *soto*. Currently both his older and younger brothers sell *soto* and even though all three of them rent the same house each own their own business.

GU begins his day around 3am when he goes to the market to shop for supplies. After preparing his supplies, GU will typically start selling around 6am. His selling day ends around 12 or 1 in the afternoon, after which he rests before shopping again for the next day's business.

The length of GU's route is around 3km and he circles around areas that are mostly private students' dormitories (*kos-kosan*), his main customer base. Because most of GU's customers are students, during school breaks he returns to his village in Gunung Kidul to work in his parents' rice field.

GU typically has around 40 – 50 buyers per day and 30 – 40 regular customers. GU's customers typically would know that he is nearby by hearing his shout, *"soto soto soto"*, or remember the time that he usually arrives at their location. He does make a conscious effort to be in a particular location at specific time.

GU's daily net income is between Rp 30,000 to Rp. 50,000 ($3.33 to $5.55) or around Rp 750,000 to 1,250,000 ($83.33 to $138.89) per month, which is slightly above Yogyakarta's 2010 minimum wage of around Rp. 750,000 ($83.33) per month.

GU does not own his own mobile phones, because he can't afford one yet, but when he needs to use one he would uses the mobile phone owned by one of his brothers. He sees mobile phones as important tools to keep in touch with friends and families.

Maybe due to his prior experience working on a plantation

in Sumatera, GU makes a distinction between his business and personal expenditures as well keeps records of his business expenses.

3) SB a Lontong balap Seller from Surabaya

SB sells *lontong balap*, a traditional food popular in East Java. Unlike SU and GU, SB does not own his business but is one of around 20 other sellers that pedal this food for a local businessman who specializes in peddling *lontong balap*. Besides providing the main ingredient for *lontong balap* (*lontong*, bean curd, and *lento*), the local businessman also rents out the cart needed by the sellers to peddle their trade. The rent for the cart is typically Rp. 4,000 ($0.44) per day and includes room and board for the renter at a workers dormitory run by the business owner

Even though SB starts selling around 7:30 in the morning, his day will typically begin around 4:30, when he goes to the market to shop for additional supplies, and pick up, clean, and prepare his cart. On average, SB ends his day around 3:30 in the afternoon but this depends in part on sales: on good days he may sell out and stop sooner, and on bad days, he may need to extend his hours. He estimates the length of his daily route at around 12km.

SB's daily gross income is around Rp. 230,000 to Rp. 250,000 ($25.56 to $27.78) from which he takes home around Rp. 80,000 to Rp. 100,000 ($8.89 to $11.11) per day. This is equivalent to Rp. 2,000,000 to 2,500,000 ($222.22 to $277.78) per month, double the regional minimum wage and equivalent to the starting salary of many mid-level civil servants.

SB has been selling *lontong balap* for almost ten years now, since 2000. Prior to selling *lontong balap*, SB has tried selling several other types of food, like *bakpau* and *bakso*, but found that *lontong balap* was the most profitable product compared to these other foods. But he acknowledges that one major drawback of *lontong balap* is that it is only popular with local residents of Surabaya and outsiders do not really like this food. This is also reflected by his customers who are mostly local housewives, elderly people, and long time residents of Surabaya. Because of his relatively small customer base he tries to maintain the quality of his food and would make a loud distinctive noise, by hitting his plates, to notify his customers that he is passing their location.

SB's wife and children are all back in his home village in Kediri. He goes back home every 15 or so days and stays there for three to four days before returning to Surabaya. Unlike many of our other vendors, SB's wife does not work outside the home. Although SB does not own a mobile phone, his wife has one and uses it to call him on the landline phone at his residence or through the mobile phone of one of his co-workers.

SB wishes to have his own permanent place to sell *lontong balap*, so he wouldn't have to physically exert himself too much, but he admits that having a permanent store might be problematic for him since he goes back to Kediri every 15 days, which would resort in the shop not being attended to while his back home visiting his family. In addition, because of the small number of potential buyers for *lontong balap* he can only reach a small number of customers if he is permanently situated in one location.

D. Information Needs and Mobile Phone Practices

Findings from our study highlighted the business practice of mobile food vendors, the mobile nature of their business, the ordering behavior of their customers, and the constraint that geographical range poses on the number of potential customers the vendors can encounter. These findings point toward four main information needs that we consider to be essentials for the mobile food vendors' business: information on location, menus preordering, customer's recommendation, and occurrence of special events. Significantly, each of these needs can be met (and in fact are currently being met) in a variety of ways, ICT-based or otherwise. By starting from an ethnographically-informed information needs framework (rather than starting with identified systems or devices) our project is open to both technical and non-technical interventions, as well as hybrids of the two. It therefore avoids the narrowing and implicit technological determinism sometimes associated with 'device-first' approaches in the ICT4D field.

1) Location Information

As our preliminary work suggests, food cart vendors face persistent challenges in informing regular and potential new customers about their availability. This challenge is currently met by three basic strategies. The first is to produce a distinctive sound to announce their arrival, which might be as simple as shouting the name of their product or generating a distinctive noise widely associated with the product in question – for example, the distinctive bamboo gong widely used by *bakmi* sellers to announce their presence (leading to widespread reference to *bakmi* as *"mie dug dug,"* after the sound of the gong). A second strategy is temporal: numerous vendors reported sticking to a regular schedule so that regular customers would know when and where to find them.

A third and relatively recent strategy involves the use of mobile phones to announce availability. Of the 21 vendors we interviewed, 16 either owned and used a mobile phone or had regular access to one through family members Several of these deployed their phones to disseminate location information to customers. In one version of this, regular customers would simply call vendors to inquire their current locations and arrival time at specific locations. In another, vendors use their phones to miscall[8] or SMS regular customers,, signaling the seller's availability.

2) Menu Preordering

In some cases, a significant portion of vendor business relied on special orders from regular customers, often in response to parties or other hosting functions being held by the customers. Orders for these kinds of catering functions have traditionally been arranged face to face, with customers stopping vendors on their route a day or two before the event to place the order. Increasingly, however – at least among those vendors with current access to phones – such

[8] A strategy where the vendors would make a call and hang up before it is connected. The caller will not incur any charges for making the call as long as it is not connected.

arrangements are handled via cell phone, with customers phoning or texting their orders beforehand. In either version, preordering plays an important role in building and maintaining customer relations, supplementing or stabilizing vendor income, and improving the predictability of demand, leading to better up-front purchasing decisions..

3) Trust, Discovery, and Customer Recommendations

Beyond additional capital to expand their business, the most frequent response to our question - *"the one thing that can most improve your business?"* - was the need to attract and retain new customers. As noted, part of the problem here is spatial: since the vendors' route is permanent and rarely changes, the numbers of potential customers they encounter remains more or less constant. A key challenge then becomes convincing potential customers within their range to try their food. But new customers are typically deterred by at least two barriers: first, simply not knowing about these vendors (given their lack of a permanently visible location); and second, concerns or mistrust about the quality (including health quality) of their food. At present, it seems such information is passed for the most part informally through social networks (e.g., individuals recommending particular vendors to their friends). Another solution to such information asymmetries [5], are new signaling mechanisms whereby vendors and their customers may communicate the availability and quality of particular vendors to other potential customers [37]. Here location information together with recommendations or suggestions by the mobile food vendors' existing customers may assure and attract other potential customers. But currently there is no easy and cost effective way for either location information or customer recommendations to be shared.

4) Information on Special Events

While vendors main method of finding customers follows a strategy of spatial search, at times they will set up their businesses in other and relatively stationary locations around one-off or unscheduled public gatherings, for example, open air concerts, public rallies, graduations, or fairs. Awareness of these events, and the possibilities of supplemental sales and income they present, are therefore an additional crucial information need expressed by vendors in our study. At present, much of this information passes informally. Most of the vendors we studied described informal social links with other vendors of the same or similar food types, and meet occasionally to share news, tips, and recommendations (though such information sharing is sometimes conditioned by concerns around competition). Sometimes these events are attended as a group, as evidenced by one of the vendors in our study who reported,*"The other day there was an Fun Bike event in JPP we [my group of lontong balap sellers] went there together and start selling on the side of the road. … Or when there is a graduation here in ITS we would also start selling on the sidewalk."* It is clear that timely information about such supplemental events constitutes a fourth important information need amongst the food cart vendors studied here.

V. SUPPORTING THE INFORMATION NEEDS OF MOBILE ENTREPRENEURS

To support the previously described information needs, we've designed a system to be use by mobile food vendors in their daily business activities that leverages the local GSM telecommunication networks (specifically GPRS and SMS services) as well as utilizes simple mobile phones and GSM-based GPS devices (personal tracker). The ways we envision the system to be use are as follow (see fig. 3 for a graphical representation). From the mobile food vendor's perspective, besides using their usual mobile phone, they also will be given a personal tracker and an ID that can uniquely identify them to their customers. Before starting their route, the vendor will attach the personal tracker somewhere secure and sturdy in their cart. After turning it on at preset intervals the personal tracker will query the onboard GPS for its current location and sent this information via GPRS to our application, which will update the vendor's location information.

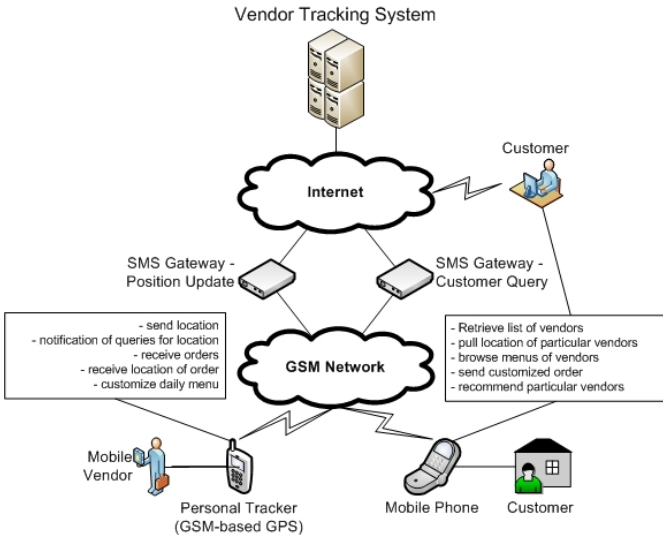

Fig. 3. Usage scenarios.

From the customer's perspective, the system will have three main functionalities, the ability to query the real time location of a vendor, to download the vendor's menu, and to preorder an item from the vendor's menu. All of these functionalities are executed by sending a SMS with the appropriate text command and the vendor's ID to a predefined number. The predefined number is basically a GSM modem that will act as a SMS gateway that will receive text messages sent by the customers and forward it to our application for processing. Our application will then query its database, generate the appropriate response, and relay this response back to the SMS gateway for transmission back to the requesting customer.

An added side effect of assigning vendors a unique ID is that their customers can easily recommend their favorite vendors to their friends by simply informing them the mobile vendor's unique ID, which later they can use to query and try out the vendor's offerings.

At the same time, the vendors, during their route, will receive SMSs to his mobile phones notifying of the various queries, information requests, and orders they have received

from customers or potential customers.

Because of the various documented potential problems in deploying ICT-based systems in developing countries [11], we adopted a *"pragmatic design"* [29] approach toward our system's design effort, where we would leverage currently available infrastructure and systems that are known to be widely available and workable in the environment of the developing world. This concept of reusing currently available systems for ICT4D applications has been advocated by numerous other authors, such as [20] and [30]. With these regards, we have intentionally designed the system to be a mobile phone and text based application. This decision was based on five major considerations. First, based on our study, the majority of the mobile food vendors do own a mobile phone. Second, Indonesia has a relatively high mobile phone service penetration rate. Telkomsel, the current market leader with 55% market share, boast of having 95% coverage of the population[9]. Third, in view of their low daily income, we believe that these vendors could not afford high-end smart phones and most likely will only own low-end phones that do not have high computing power but are sufficient for them to make or receive calls and SMSs. This insight is important because it removes the prospect of having high computation processes to be conducted on the vendor's phone and resort the device to only being a terminal to receive and send information. Fourth, also because of the small resources available on low-end phones, we believe text is the best form for information to be sent, received, and stored in these phones. And fifth, Indonesia's mobile phone service pricing structure is typically much cheaper to send a SMS than to make a call, for example: Simpati, one of Telkomsel prepaid program, the current rate to send one text message is Rp. 150 (1.7 cents), there is no charge to receive text messages, while the cost to make a one minute call to another mobile phone is Rp. 1,800 (20 cents) for the first two minutes.[10]

In addition, due to location as being one of the identified information needs of these vendors, the system must also be able to track the location of the vendors in their route. Fortunately, GPS devices that are able to transmit their coordinate in real time via a GSM or GPRS network are starting to be widely available. These GPS devices are currently being marketed as personal tracker to keep track of vehicles, pets, and even children. This personal tracker typically has a ping feature where a preprogrammed mobile phone number can query the device current position as well as to periodically report its position to a previously specified mobile phone number, if using SMS, or IP address, if using GPRS. For this device we opted for a GPRS capable device rather than a SMS capable personal tracker, which will give a more reliable and quicker transmission rate. By using a text-based system we do acknowledge there might be a literacy issue in using this application. But based on the findings of our study, we expect the majority of the mobile food vendors to have undergone some type of formal education and should be able to read and write. Furthermore, Indonesia currently has been operating a nine year mandatory lower education program for the last twenty years. But we believe eyesight will be a major concern in using a text-based system. The *pecal* seller, profiled earlier, noted this as a central reason that she is not using a mobile phone.

[9] http://www.telkomsel.com/web/cbs_wireless

[10] http://www.telkomsel.com/web/tarif_kartu_simpati

VI. Conclusion

This paper reports on an ongoing research project that further inform on the working and living conditions, business characteristics, mobile phone usage, and information needs of mobile microentrepreneurs in the developing world, specifically mobile food vendors in Indonesia. We identified four major information needs of these vendors: location information, menu preordering, customer recommendations, and information on special events. Based on these findings, we also present a preliminary sketch of a mobile phone-based application that addresses those needs in an infrastructurally sensitive and ethnographically informed way. Our initial design proposal (undoubtedly to be refined in an iterative way as we move into field trials in the coming months) accommodates the specific conditions of the Indonesian wireless market, notably widespread adoption and use of SMS-enabled phones, and cost and availability barriers ruling out more expensive smart phones and corresponding service plans..

The next step for this study is to do a field trial of the system to test its usability and potential impact on the vendor's livelihood, to be carried out in summer 2010. Furthermore, we are also planning to conduct further ethnographic studies to investigate various privacy issues pertaining to location information for users in developing countries as well as to get a better sense on the price sensitivity of mobile food vendors and their customers for using such a system. Moreover, as pointed out in [16], we expect to experience a *"realization"* that will uncover various issues pertaining to our system design, which we will ultimately conduct appropriate *"adaptation"* to its design.

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