Digitizing Monetary Ecologies: Intended and Unintended Consequences of Introducing a Financial Management App in a Low-Resource Setting

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This paper reports on the changes in the monetary ecology around loan payments shortly after the introduction of a mobile app in Karnataka, India. The app was designed to be used by a social enterprise working with auto-rickshaw drivers by enabling them to take out loans to buy their auto-rickshaws. The app was intended to provide timely loan information for the drivers and support the collaborative work of loan collection and payment. We report on the initial experiences with the app, exploring both its intended and its unintended consequences. We do this by comparing the workflows before and after introduction of the app through the lens of the three phases of moneywork: that is, what changed during pre-, at-, and post-transaction moments. Whilst the app certainly streamlined the workflows, unintended consequences arose from making previously hidden work visible, as well the shifting of control towards the back office, reducing field agents' flexibility.

CCS Concepts: • **Human-centered computing** → User Studies; • **Collaborative and social computing** → Computer Supported Cooperative Work

KEYWORDS

Ethnography, Monetary Ecologies, Monetary transactions, Paper, Digitization, Collaborative Work

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1. INTRODUCTION

In this paper, we report on the initial experiences of the deployment of an app that was designed to support the collaborative work of loan repayment by auto-rickshaw drivers and field agents in Karnataka, India.

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The app was intended to provide timely information on loans to the beneficiaries i.e. rickshaw drivers, to help them make conscious payment decisions; help the field agents keep track of drivers' payments; streamline the workflows for the concerned organization, and thereby overall improve drivers' chances of owning their auto rickshaw within five years. Microsoft Research India entered into collaboration with Three Wheels United, a for-profit social enterprise that works with auto rickshaw drivers and their families to improve their lives by arranging for loans for rickshaws from banks that are reluctant to lend directly to drivers.

The effort to use digital technology to aid loan repayment should be seen against the broader context of the Indian government's efforts to achieve financial inclusion of the poor [15, 32], including providing everyone with a bank account [26]. An ambitious National Mission on Financial Inclusion was launched on Independence Day in 2014 by the Indian Prime Minister, which called for banks to open no-frills, 'zero balance' accounts for the unbanked poor. Financial inclusion is expected to develop "… a culture of savings among large segments of the population" and mitigate "exploitation of vulnerable sections by the usurious money lenders by facilitating easy access to formal credit" [15, p. 3]. The government's efforts have resulted in expanding banking services to 100 million Indians, bringing the total percentage of the country's banked population to 62% [10]. However, only 2/3rd of those who have a bank account are reported to use it actively (ibid).

These developments in India reflect a more general trend within the technology and international development community, which often seems to be pinning its hopes on a relationship between digitization of financial services and financial inclusion. As Nelms and Rea suggest, "Mobile money has been heralded by the development community as a means of alleviating poverty and reducing economic inequality by bringing the poor and un- or under-banked into formal financial systems" [28, p. 3]. The arguments for using technology to deliver financial services are, in short, that they save time and transportation costs, provide security, and act as a channel enabling access to a range of financial services, including loans, savings and insurance [2, 6, 13, 14, 15]. The most prominent success case so far is M-PESA in Kenya, where money transfers can be done via mobile phones [20, 21, 22]. However, this success has proven difficult to replicate, and overall mobile money is mainly used for person-to-person transactions (e.g. remittances) over long distances, or in places where having cash is risky. The main reason for the difficulties with implementing is that digital financial services are not only about the transaction or technology itself, but also about the larger ecosystem around them [13, 16]. Thus, according to Nelms & Rea, "Perhaps the most important insight from the first decade of mobile money research is, then, this one: one size does not fit all." [28, p. 7]. Thus, the viability of using mobile technology for the benefit of the poor, in practice, remains uncertain [13, 42, 29J].

Consequently, if mobile technology is to move towards the fulfillment of the envisioned goals of financial inclusion, there is a need for better understanding the ecosystem around financial transactions and practices. With this aim, we analyze in this paper the initial experiences of an app designed for intermediated, collaborative financial management in the case of auto rickshaw drivers in Karnataka, India, and thus add novels insights to the growing body of work around digitization and financial inclusion.

2. RELATED WORK & THEORY: MONETARY ECOLOGIES AND MONEYWORK

Money is an artefact that can exist in various forms: in kind, as cash (paper and metal), or digital in bank-, debit-, and credit cards, internet or mobile-based. Lately, bitcoin and other cryptocurrencies have received attention not only for their link to criminal activities and high-risk speculation, but also as a design challenge [34]. However, as the sociologist Simmel pointed out more than a hundred years ago, money is also a form of social relation: "Money lubricates transactions because of the ways that people are able to reflexively use its material, impersonal, and quantifiable features (thus allowing exact calculability, division, manipulation, and comparison) to replace personal relationships with a more restricted form of interaction that references "rational," impersonal, and reciprocal associations" [33, p. 41:5]. Analyses of practices around money, whether in the context of everyday financial transactions or institutional transactions, have to consider the broader 'ecologies' at play, since the act of making a monetary transaction is dependent on such larger networks or ecologies. Maurer [23] describes 'monetary ecologies' based on Tankha's formulation as 'the assemblages of technologies, objects, animals, people, relationships, forms of property, and methods of record-keeping that, together, make up the world of value and exchange in people's everyday lives' [43]. Hence, while on the one hand a shift from paper to digitally-based money may well take advantage of the differences in affordances between them, the wider social relations and networks of which they are part must also to be taken into consideration [18, 33, 48].

The importance of monetary ecologies can be illustrated by two cases, M-PESA and the Bristol Pound. M-PESA was launched as a mobile-based P2P transfer in 2007 by Safaricom in Kenya. Nearly a decade later, it expanded its services to include savings, credit, bill payments, and so on for the country's unbanked. M-PESA has been widely adopted, which can be attributed to a variety of factors: At a micro level, the network of retail agents, who constitute the most vital piece of the social infrastructure interacting with the digital (mobile) infrastructure, ensures that the service delivery is effective [21]. At the same time, M-PESA's massive adoption was dependent on macro-level factors like a conducive regulatory environment in Kenya, Safaricom's near-monopoly status in the telecom sector, distrust of formal financial institutions, and established, deep social networks of familial ties and a sense of responsibility that enabled remittance practices [28]. Bristol Pound (£B) is a local currency used in Bristol, England, launched in 2012, complementing the Pound Sterling with 800 businesses listed as members committed to transact with it, and around 1 million £B issued. It can be used in paper as well as digital forms, and digital payments via SMS or online require an electronic £B account to be opened. Its spread has not so much been driven by its availability in digital form, as by the strength of community networks, a high degree of interpersonal trust (as opposed to institutional trust), and a commitment to strengthen local community and keep money in the area [9].

Thus, while monetary transactions are often focused on analyses of money such as in the abbreviations P2P (peer-to-peer), P2B (peer-to-business) and P2G (peer-to-government) (See e.g. [42]), one has to mind one's 'P's and '2's [28]. The apparent atom of two actors and a transaction mediated by a form of money and technology, can take multiple forms: The 'P's may not be singular individuals, but families and kin, and credit cards may be shared between family members [47], and the '2's are rarely singular artefacts, but usually part of larger infrastructures such as mobile phones which are dependent on a multitude of technical functionality, standards and agreements and imbued with social significance and sociality. Nelms and Rea [28], in an

overview of the last ten years of experience with mobile money, point at ten contextual complexities around the P2P atom: agent networks; physical infrastructure; location, place, and space; kinship and family; gender and gender inequality; class, caste, and rank; religion and ritual; time and tempo; government and regulation; and the persistence of both cash and non-currency stores of value (ibid).

2.1 Co-producing Moneywork

One way to get an analytical grip on monetary transactions, the P2P atom, and monetary ecologies is the framework that Perry and Ferreira develop through their concept of 'moneywork': "the interactional work around the use of money in making financial transactions" [33, p. 1]. To answer their research question about *how* people accomplish transactions, they propose to provide a sequential description of the activities and artefacts involved. They demonstrate, through the case of the Bristol Pound, how "people traverse an ecology of interlinked, money-related activities and exploit the respective affordances of the technologies and social resources that they have at hand to enable the unfolding transactional demands that they encounter" (ibid, p. 30). They point at how monetary transactions involve solo interactions on mobile phones, interactions between co-located actors, as well as interactions with remote actors and the integration of heterogeneous social and technical infrastructures.

In their framework, Perry and Ferreira make a tripartite distinction between pre-, at-, and post-transaction work that is done by the different actors involved to make the transactions happen. *Pre-transaction* work includes decisions to make a transaction and the necessary preparations for making that possible; *at-transaction* activities include managing social interactions around the exchange, getting the payment device ready, agreeing upon and performing the exchange, as well as confirming and closing the interaction; finally, *post-transaction* work concerns the activities following the transaction closure and includes, for example, housekeeping activities, preparing for the next transactions, and sharing information about the transaction [33]. Perry and Ferreira (ibid) contend that, "looking at the articulation work that people have to do around making digital money work for them offers real insights into the potential for automation and the need for retaining human skill and judgment in solutions" [33, p. 25] . In the analysis below, we will draw upon Perry and Ferreira's pre-, at- and post-transactions framework.

2.2 Paper – Digital Artefacts

One important aspect of the monetary ecology is the materiality of money, which, as mentioned, can be paper, metal, plastic, digital, etc. Of particular interest to our case is paper- and digitally-based artefacts around monetary transactions, because of the different affordances they provide for conducting the same. The various affordances of paper and digital and the different ways in which they support and augment collaborative work in general have been a subject of long term interest within CSCW. For example, the early paper by Luff and Heath [17] points at the micro-mobility that paper provides in face-to-face interactions (in contrast to computers) and, thus, be jointly viewed and turned around; and, later, Sellen and Harper [38] highlight paper's ability to be folded, easily carried around, and absorbing ink as crucial factors in paper's prevailing presence in work settings. Holding paper (a contract, money, or check) can convey 'ownership' [11, 30, 31, 45, 46], and putting paper on top of a pile (a medical form, an instruction, a message) can signal priority or be used as a reminder system. Thus, due to the different affordances, shifting from the medium of paper to digital can have crucial repercussions for collaborative workflows (for cases within healthcare, see for example [17] and [39]).

3. CASE, SETTING AND METHOD

3.1 Setting

Auto rickshaw drivers are classified as urban poor, even though they are not amongst the poorest in India [5, 6, 27]. They are self-employed and come under the unorganized sector, to which more than three quarters of the Indian workforce belongs [7]. Consequently, they do not enjoy fixed, regular incomes. Because they are *not* below the official poverty line, they are not eligible for many social security benefits either. With average daily earnings of about 600-800 INR (approx. 9-12 USD), their financial situation is precarious, and estimates indicate that more than 70% of auto drivers in India do not own their auto rickshaws [1, 5, 6].

Three Wheels United (TWU hereafter) aims to improve the lives of auto rickshaw drivers and their families by facilitating loans for them to purchase their own rickshaws. Since banks do not typically agree to do so, because of the risk of default and the absence of a credit rating, TWU acts as an intermediary between the banks and auto drivers by standing guarantor to the loan, and is currently operating in two cities in Karnataka, India – Bengaluru and Chitradurga. Auto rickshaw drivers who do not own their auto rickshaws have to rent them and typically pay a daily rent of 200-250 INR (approx. 3-4 USD) [5, 29]. TWU aims to enable drivers to become owners of their rickshaws after a period of roughly 40-45 months by paying an installment approximately equal to the daily rental rate of 200-250 INR (i.e. 5000-5500 INR per month).

TWU restructures the five-year bank loan into a three-year period so that even if drivers miss some payments, banks will not knock on their doors and claim their autos back: The buffer provided by paying a little more each month to the bank mitigates the very real risk of default. TWU also arranges for a smaller Security Deposit Loan (SDL hereafter), because drivers are often unable to pay the full deposit amount required at the time of purchasing the auto. The SDL tenure is 18 months.

Finally, TWU, in order to sustain itself as an organization, charges a fixed monthly fee for services rendered with respect to managing the loans as well as handling drivers' paperwork. In other words, the loan has these 3 partitions: a main bank loan, a smaller SDL, and TWU fees. After collecting payments from drivers in cash, the TWU field agents deposit the amount in the bank, and the TWU back-office staff then make the allocations of payments into different buckets. Because drivers' incomes are cash-based, daily, and unpredictable, TWU's loan scheme permits flexibility in this payment process by allowing the drivers to pay daily, weekly, or monthly (although smaller, more frequent payments have been known to be the most effective). Furthermore, by standing guarantor to the loan and managing loans with the drivers and handling paperwork on their behalf, TWU strives to achieve the financial inclusion of this vulnerable section in society.

Figure 1. A TWU driver on the streets of Bengaluru

The field agents are the key link in this process as they have an intimate knowledge of the drivers they manage, help them with payments and paperwork, and coordinate with the back-office. They provide counselling during times of financial stress and motivate drivers to pay on time, so that they do not fall behind and get their autos confiscated by the bank. However, with each field agent responsible for approximately 30-50 drivers paying according to no fixed schedule, it became increasingly difficult for them to manage their drivers and keep track of their payments, and since the back-office also was in need for streamlining their collection of ad hoc systems, the idea for going digital seemed promising. Based on ethnographic fieldwork to elicit the details of loan payment, and design workshops with field agents, drivers and back-office staff, first a backend system for the office, and then a smartphone application for field agents and drivers were developed. The initial design ideas were revised and finalized in an iterative design process that involved six design workshops and a qualitative user test with the field agents and drivers (See [24], [25], and [29] for more).

3.2 Methods: Data generation and Analysis

This paper discusses the findings of an ethnographic study of the app usage by the field agents during October-November 2017, the first two months following the app deployment. The first author carried out observations and in-situ interviews to obtain a rich picture of loan collection

and repayment from the perspective of various stakeholders involved i.e. the auto rickshaw drivers who are repaying their loans, the field agents from TWU who are managing their payments and paperwork, and TWU's back office staff managing the allocations of drivers' payments into the three buckets.

Prior to the introduction of the app, a survey aimed at eliciting data on how well and how much drivers know about their loans was conducted during July-September 2017. The survey covered education, family, technology use, financial situation including earnings, savings, and their loan with TWU. The survey was administered by the first author and two collaborators in Kannada, the main language spoken in Karnataka state, and in Hindi, which some drivers preferred. Responses from 143 out of around 200 drivers in total were obtained.

After the app was introduced, the first author conducted 10 days of participant-observations, spending 5-6 hours per day on average in the field, with all five field agents at TWU, who, for anonymity reasons, will be called 1, 2, 3, 4 and 5. Field agents 1, 2 and 3 operated in Bengaluru, whereas field agents 4 and 5 operated in the district of Chitradurga[1]. Observations included accompanying field agents on their collection rounds in the field, spending time at the TWU office in Bengaluru, and attending loan payment sessions in the local offices in Bengaluru and Chitradurga. The observations were recorded through extensive field notes, and additional data was collected through audio recordings and photographs. Verbal informed consent was duly obtained from all the participants. Over the 10 days of observations, the five field agents made 83 calls to drivers, a majority of which were to follow up with drivers who had not paid as agreed upon. Also, 25 drivers (or their families) were visited; 31 payments were received, two of which had been made to the TWU head office directly; 13 drivers were reported by the field agents to be missing from their lists in the app; 28 drivers were requested to be reallocated or removed from their lists; and 7 visits were made by field agents to the bank to deposit the amount collected. More than 30 drivers (from all field agents) had 'green edges' around their profiles in the app, signaling that they were the 'good' drivers who had paid the correct amount on time. Some of them had even paid in excess and were hoping to complete their loan as soon as possible.

Ethnographic fieldwork has proven immensely useful in informing design [35], since participant-observation and interviews are effective ways of eliciting the interrelations of actors, technologies and practices [3]. For analysis, extensive field notes were written, and read through collaboratively in order to identify themes and significant features of app usage. Working through specific examples and experiences of participants' activity and app usage based on the observations and in-situ interviews carried out, we constructed themes around how our participants used the app, problems they faced with it, and the ways that they made sense of and distinguished between digital- and paper-based forms of work processes. Patterns in the data were identified and named following the thematic process [2].

4. FINDINGS

4.1 Pre-app workflow

Prior to the introduction of the app, the workflow was organized as follows: Auto drivers would pay by cash or cheque to the field agents. Some drivers would drop by at the field agent's office and pay. With other drivers, the field agents had to search for and locate them in order to get

[1] TWU operated in Bengaluru and Chitradurga cities and therefore these two cities were the sites of fieldwork.

payments. There was a mix of daily, weekly, and monthly payments. Whereas few drivers paid monthly during the initial study in 2015, by the time of the survey 103 out of 143 survey respondents reported that they paid monthly, due to various operational changes by TWU and its field agents. Also, 128 drivers stated that they knew how much they had to pay each time. After receiving several payments, the field agents would deposit the cash in the bank. The deposit receipt would then be sent to a WhatsApp group that had been created for the TWU staff. The back-office staff would then verify the payments and make the allocation into the three buckets. For record-keeping at the back-end, TWU maintained a mix of paper and digital artefacts such as spreadsheets and software applications. Information was siloed in different systems and was rendered useless for taking important operational as well as strategic decisions by TWU.

Overall, because the records were many and disparate, the loan information was spread out across various sources, disconnected from one another. Furthermore, because allocations into the three buckets were done by the back-office staff, neither the field agents nor the drivers had any updated information on loan status. The field agents merely knew if the drivers had missed any payments in the immediate past and had thereby accumulated arrears. To get the latest status of their loans, drivers had to go to the TWU office half away across the city or go to the bank where they had their loan account, which entailed transactional costs on the already financially vulnerable drivers (the fuel costs, considerable waiting time especially in banks, and the opportunity cost of losing rides, which meant lost income). To improve this situation, first a backend system and then the app was developed. The backend system, as mentioned, collated information from the disparate sources and enabled pushing accurate and timely information to the app and thus to the field agents and drivers. Given that drivers had limited literacy skills and used feature phones without data, a smartphone application was designed to be used by the field agents as part of their interaction with drivers. The design and development of the intervention including the back-end system have been discussed in detail elsewhere [See [29] and [24]], whereas the development of the app including its features are presented in [25]. For an impression of the app, see Figures 2-4 (below).

4.2 Post-app workflow

With the introduction of the new system, field agents found themselves using the smartphone application for the first time, while the office staff had already been handling the new back-end system since January 2017. Whereas the back-end operations were fully migrated to the new system, that was not the case with the front-end interaction between drivers and field agents. In this section, we elaborate upon what the introduction of the app meant in terms of re-organizing the workflow, and how it affected the interactive dynamics between the different stakeholders involved. A useful analytical way to contrast the work that field agents and drivers did before and after the deployment of the app and post-deployment is to compare the moneywork at pre-, at-, and post-transaction moments using the framework of Perry and Ferreira [33].

4.2.1 Pre-transaction

Before the app could be used at the time of interaction with the auto drivers, a set of preconditions had to be satisfied. This amounts to the preparatory work to be carried out in order to conduct the transaction as smoothly as possible (ibid: p. 16). First, the field agents must have their smartphones with them at the time of meeting their drivers. The phone should be adequately charged, because drivers sometimes meet the field agents on the streets. Second, the app must be working properly. Third, information on the app/system needs to be up-to-date,

because the expectation is that the field agents will use the app for following up with drivers, arranging meetings, recording payments, and so on. Here, the back-office staff plays a crucial role in keeping the data in the system up-to-date, as well as providing technical support and maintenance of the system. *Data completeness* and *data accuracy* are imperative for the app to be used meaningfully. As far as the drivers are concerned, they need to have their passbooks with them at the time of making the payment. The date, amount paid, and the driver's and field agent's signatures are recorded for each payment. If somebody else (say, a friend or family member) is paying on the drivers' behalf, then the passbook needs to be handed over to this person. The drivers need to have saved up the amount and bring the cash with them for the payment. In the pre-deployment survey, 60 out of 143 respondents reported that they set aside money towards loan repayment every day, whereas 56 drivers reported that they saved at more irregular intervals.

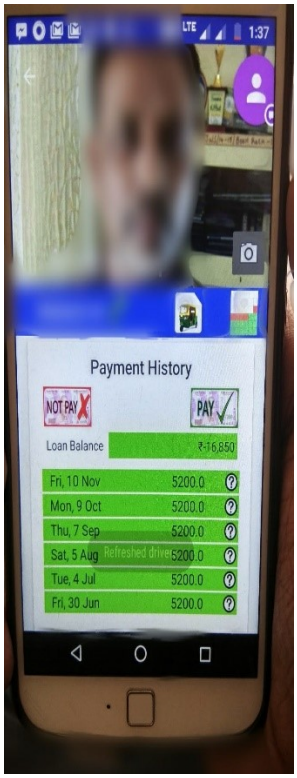

Figure 2. Payment History

The Driver screen, showing photo, name, phone number (blurred for privacy), and payment history. 'Green' indicates correct payments on time. At the time of payment, the field agent presses 'Pay', and the driver enters the PIN, and the payment is recorded.

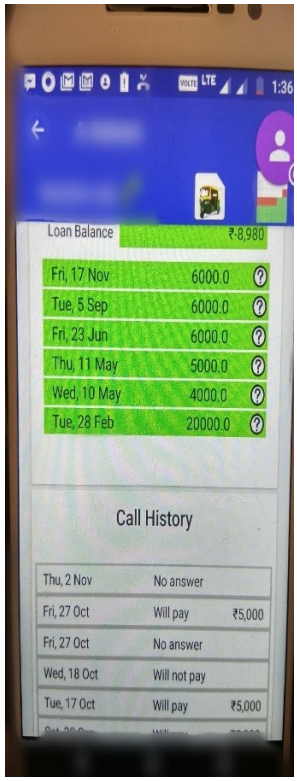

Figure 3. Call History

As the field agents scrolls down the screen, he/she can see the 'Call history', providing at-a-glance information on calls to a driver, and short statements on payment, as well as the amount agreed upon.

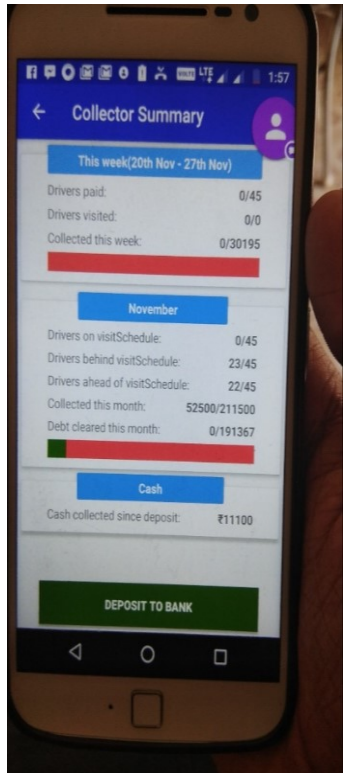

Figure 4. Field agent screen

The screen sums up payments received; number of drivers who have paid or not, etc. Also the cash amount the field agent has to deposit in the bank is shown. A 'Deposit to bank' button leads to a screen for taking a photo of the deposit receipt, which is sent to the back-office.

The drivers also need to (ideally at least) have their mobile phones with them so that if they do not remember their PIN, it can be generated in-situ and sent as an SMS to their registered mobile number. Drivers' also receive a payment-confirmation SMS after making the payment. Finally, TWU wanted regular, frequent payments from drivers, and preferred weekly to monthly payments, since the former in their experience led to better loan repayment adherence. However, as we shall see, there was a tension between what TWU management desired and field agents' practices, and, as mentioned, by the time of deployment most drivers had moved onto monthly repayments.

4.2.2 At-transaction

If all the preconditions mentioned above were met, then the field agent would set up a 'Payment Schedule' upon meeting the driver for the first time. Upon setting up this schedule, preferably weekly, the driver would pay the amount in cash, and the field agent would go to the driver's screen and record the payment. The driver would enter his PIN for this to go through. The payment would be immediately visible in the app in the driver's payment history along with the five most recent payments, and the driver would also receive an SMS from TWU acknowledging his payment on his own mobile phone. This SMS does not mean that the money is already in the driver's loan account, but merely a confirmation of the fact that the amount has been handed over to TWU. At the time of transaction, field agents perform quite a bit of work with paper artefacts as well. The introduction of the app has not replaced the use of paper records, nor was it intended to replace drivers' books or receipts, although it had been hoped that it would replace the field agents' ledgers. However, as we shall see, for various practical reasons this did not happen. After payment, all five field agents entered the payment details in the drivers' passbook. However, when it came to maintaining paper records for themselves, field agents' practices varied. Field agents 1 and 2 would tear a leaf of a printed receipt, fill in the necessary fields, and give it to the driver or someone paying on his behalf. They retained a carbon copy of the same in their books. Both 1 and 2 would come back to their offices and then copy these payment details to separate ledgers they maintained for keeping a record of their drivers' payments. These ledgers, however, never left their offices. This contrasts with field agents 4 and 5 in Chitradurga, who took their ledgers (in addition to the receipts book) to the field. They considered it good practice to have a record where they got the driver to sign next to the payment details. Although all of it was handwritten, the drivers' signatures lent it significance. A driver's passbook would have his signature too, but it typically remained with the drivers. 4 and 5 also maintained a soft copy of their records on excel sheets.

Since, the app was intended to augment the interactional work that field agents perform in collaboration with the drivers and help the latter understand their loan situation better, a key design intention for the time of transaction was that the field agents would use the app, specifically the drivers' screens including the 'Loan Status' and 'Loan Ending' screens to aid them in providing financial counselling to the drivers. The 'Loan Status' screen showed the different loan buckets with the amount paid off and the amount remaining to be paid for each bucket. The 'Loan Ending' would visually show the future cost of present payment decisions. These screens were designed to be used with the driver as occasioned by the interaction.

4.2.3 Post-transaction

After the payment is done and all the details are recorded on the app and paper records, the field agents go to the bank periodically and deposit the total amount collected. Field agents 4 and 5 did

this thrice a month, whereas field agents 2 and 3 did it more frequently, as they did not like to keep large sums of cash lying around. Upon depositing the amount, the field agents get a receipt from the bank. They use the app to take a photo of the receipt and send it to the back-office. The important thing here is for the field agents to make sure that the total amount collected from various drivers (which is automatically calculated by the app) matches the amount in cash they have at hand *before* they go to the bank. If there is a mismatch, they should look it up and report any discrepancies. The back-office, upon receiving the deposit receipt photo, verifies if the amount on the receipt matches the amount shown in the system for that field agent. If the two match, the officer-in-charge approves them and the amounts allocated. Once the field agent successfully submits the receipt, the app resets the 'amount collected' to zero, and the cycle repeats.

4.3 Effects of App Implementations: Benefits and Challenges

The implementation of the app led to some of the expected improvements of the overall workflow of monetary transactions between TWU, field agents and drivers, but also brought some challenges to the fore. Some challenges, like field agents sometimes sending payments receipts to TWU back office via WhatsApp as previously instead of the app, can be attributed to the early stage of implementation, and getting used to a new routine. However, other features would seem to be more lasting. On the positive side, an overall integrated workflow between back office and field agents was achieved and information more updated: The back-office got information on the progress of payments, missed-payments and the follow-up process in real time, just as an accurate and *almost* up-to-date loan status was available on the app to field agents and drivers (see below). While the app was intended to work in the way described above, the on-ground experiences were at some points different. Field agents got an overview of their calls to drivers, most importantly to those who did not meet up or pay, and since the app had a 'Call Feedback' feature, field agents could record why the driver had not met up, not paid the agreed amount, and what agreement had been made as to time and amount of next payment. Thus, field agents and TWU could keep track of drivers that were behind with payments. At the same time, there were some challenges which we will describe below.

4.3.1 Pre-transaction Problems

The first key issue concerned the list of drivers for which each field agent was responsible, and upon which all five reported issues. One was that drivers who were paying to them were missing on the list, whereas drivers who were not paying to them were listed. The drivers who were missing had to be pulled up from the server each time the field agents wanted to look up their profiles, which they found cumbersome. They also pointed out that some drivers had been wrongly allocated to them in the system and that they were paying to other field agents. Field agents could not themselves change the list, which had to be done by the back-office, and field agents thus had to work around the errors.

A related, second issue that the field agents faced when using the app was that drivers sometimes changed their phone numbers. Field agents would be in possession of the correct numbers, but these were not updated in real time on the back-end, which meant that field agents were not able to place calls to drivers from the app. This, in turn, affected 'Call History'. If the field agents did not call the drivers using the app, then the 'Call Feedback' form would not pop up and 'Call History' would be empty. This, coupled with the errors in the list, made it difficult for field agents to distinguish between those drivers who had been called and those who were yet to be called. As

a result, tracking payments and following up with those who had not paid was troublesome. This led to field agents maintaining entries in their paper ledgers with different columns for driver's name, phone number, and remarks (which included call summary, amount paid or to be paid, and so on).

A third issue was that the problems with the list of drivers affected the 'Call' tab on the home screen, which was intended to provide a list of drivers who were due to pay that day or the next day. However, since the list was not correct, the 'Call' tab could not be relied upon and did not provide the field agents with an overview to support their work as intended. They also found the idea of a separate 'Call' tab unintuitive. Field agent 2, for example, reported, "I thought I would get reminders about upcoming drivers' payments like an alarm clock… like a pop-up window, you know".

A fourth issue, which also affected the 'Call' tab, related to TWU's wish to get drivers to pay more frequently and the subsequent design of the 'Payment Schedule' feature. The 'Payment Schedule' window would pop up when a driver profile was selected for the first time and had to be decided in consultation with the driver. Upon submitting it, the driver would show up in the 'Call' tab one day before he was due to make a payment. All five field agents were unsuccessful in persuading most of the existing drivers to move from a monthly payment to a weekly schedule. Indeed, field agents 4 and 5, most of whose drivers were paying monthly and on time, questioned the need to change this. That said, all five field agents opined that it was difficult, if not impossible, to get both 'good' and 'bad' drivers to change their practices. The 'good' ones would not need to, and the 'bad' ones would not want to. Therefore the 'Payment Schedule' showing seven days of a week was not useful as most of their drivers were paying monthly and would continue to pay monthly. They stated that a calendar would serve the purpose better. As a workaround to the imposed weekly schedule, field agents ended up selecting an arbitrary day of the week for monthly payers. However, drivers then showed up in the 'Call' tab on that day, making it less effective as a tool to help them organize their work.

4.3.2 At-transaction Problems

A key challenge at the time of interaction with the drivers, was the PIN, unique for each driver and used to record payments in the app. A first notable recurrent observation was that drivers did not enter the PIN in the app themselves, as intended to ensure that payments were recorded in presence of the drivers. Instead, the drivers read the PIN out aloud to the field agents who entered it on their behalf, and hypothetically *could* remember it and use it to record payments next time without the driver necessarily being present. A related issue was that, often and across all five field agents, drivers did not remember their PIN in which case the field agent would generate a new PIN in situ, which would be sent to the driver's mobile phone. However, if the drivers' phone number had changed and the new number was not in the system (see above), he would not receive the PIN via the SMS. Consequently, such payments could not be recorded on the app. In other cases, a similar situation came up when drivers were not themselves present at payment. For example, field agent 1, who collected payments weekly as well as monthly, had to visit some drivers at their homes, and more often than not the driver would be away working, and instead field agent 1 received payments from the driver's wife or children. They would not know the PIN, and generating a new PIN was no solution, since the SMS would be sent to the driver's mobile phone. Again, payments could not be recorded on the app. This is ironic, as the reason a static PIN, as opposed to a One-Time Password (OTP), was introduced, was because, it

was common for payments to be collected from friends and family members. The expectation had been that the field agents would ask drivers to write the static PIN in their passbooks.

Another challenge was that drivers, as mentioned above, were not always co-present with the field agents when payments were made or would sometimes even forget to bring their phones with them. Two drivers in Bengaluru made a payment to the TWU head office directly, bypassing the field agents. A third driver paying to 1 did not have his phone with him at the time of payment. Another driver in Chitradurga did not possess a mobile phone at all. In these instances, payments could not be recorded on the app. All five field agents' workaround for these situations was to simply follow the pre-app work procedures that they had been hitherto familiar with: enter the payment details in the driver's passbook, enter the same on a printed receipt, and keep a carbon copy of the same with them. This, then, entailed some extra post-transaction work (see below).

Third, with the 'Loan Status' screen, which was the main screen providing the overall loan information, the problem field agents faced was that the figures were sometimes inaccurate or outdated, because figures were only updated after field agents had deposited the amount at the bank, and TWU had allocated the amounts into the three buckets. The field agents did know about this but were concerned about the (in)accuracy of the loan figures (both aggregate and in each bucket). As field agent 4 remarked, "If these figures are not accurate, we cannot show this screen to the drivers. They will lose their trust in us." Therefore, it became a question not only of data accuracy, but also of transparency and interpersonal trust. With field agents 4 and 5, for example, what had happened was that a driver had made a sizeable lump sum payment of 54,000 rupees (approx. 825 USD) in June 2017 *before* the app was deployed. With the 'Payment History' showing the six most recent payments, this payment should also have showed up (at the time of observations in October and November). It did not. Upon enquiring at the TWU back-office, it was found that the officer-in-charge had deducted 54,000 rupees from the loan amount remaining to be paid (which did reflect in the 'Loan Status' screen) but had not added the same to the driver's 'Payment History'. While mathematically it made no difference whatsoever, experientially it mattered a lot – both to field agents 4 and 5 as well the driver concerned. Consequently, 4 and 5 placed immense value in their meticulous bookkeeping practices using their paper artefacts, the ledgers.

Fourth, the app showed some 'correct' payments in 'red', signaling that payments were behind in case of Chitradurga drivers. This was because of the way the allocations were made to different buckets. The SDL was a smaller loan with a shorter tenure of 18 months, whereas the main bank loan was of a longer tenure. As a result, TWU instructed its financial officer to allocate the payments to the bank loan and SDL buckets for the first 18 months, and then allocate them between bank loan and TWU fees buckets in the subsequent period. Because the allocations were made only to two buckets at a time, the app wrongly showed 'correct' payments in 'red'. As a result, the number of 'good' drivers with 'green' edges around their profiles were shown to be fewer than was actually the case. In another case, field agent 1 in Bengaluru did not use the app's 'Loan Status' screen deliberately even when she was prompted to provide the loan information by a wife and a mother of two drivers. She pointed to data completeness (or rather the lack of it) as the reason. She remarked, "The app does not highlight some payments like insurance. Insurance in the first year is covered by TWU, but from the second year onwards, drivers have to

pay for it themselves. This is shown on the bank statement, but not on the app. Any such discrepancy between the figures we quote and what is shown on the bank statement will lead to distrust on the part of drivers." She, therefore, preferred to consult her ledgers and excel sheets before discussing the loan status and did not want to take the figures shown on the app prima facie.

4.3.3 Post-transaction Problems

One kind of post-transaction work was to follow up on payments which could not be recorded at-transaction due to the lack of a PIN, as described for all five field agents above. What field agents would then do, after going back to their office, was to generate PINs for each of the drivers who had paid, call them to learn the PIN, and then add the drivers' payments on the app. Sometimes they would add one payment at a time without storing the drivers' PINs. At other times, they would note down the PINs in one of their books (so that they do not have to call the drivers each time) and add all the payments received. Unfortunately, this defeated the very purpose of designing the PIN system, which was to ensure that the app was used with the driver (or somebody paying on his behalf) at the time of payment transaction.

Another issue at the post-transaction stage was a mismatch between the total amount collected from the drivers by a field agent as calculated by the system and the amount deposited at the bank. This occurred for several reasons. With field agent 1, what happened was that she delegated the task of depositing the amount to the bank to one of her colleagues and received a payment in her office in the meantime. She added that payment on the app, which caused a mismatch between the amount on the system and the amount deposited by her colleague. While it was no cause for concern as she had the cash at hand, it was a matter of concern for the back-office staff who were not co-present with her. In these cases, field agents and back office had to communicate and resolve the inconsistencies.

In another scenario, what happened with all five field agents was that they used WhatsApp to send the bank deposit receipts across to the back-office instead of sending them via the app. This was the prevalent practice before the app was deployed and they continued doing it even after the deployment. Because more and more payments were deposited in the bank without the deposit receipts being uploaded on the app, the total amount collected from the drivers, which was automatically calculated by the system, was not periodically reset and kept growing. In case of field agent 2, the 'Cash Collected since Last Deposit' was shown to be amounting to more than 240,000 INR (approx. 3700 USD) whereas he had around 10-12,000 INR (approx. 180 USD) in his hand. The implication is that it creates opacity and can pose problems of trust as TWU scales up.

A related issue at the back-end was that the officer-in-charge was not able to verify payments added onto the system before the amount was deposited in the bank. This, in turn, imposed a constraint on updating the loan figures on the app in real time. Consequently, at the front-end, the driver and field agent could see that the 'Payment History' was updated immediately, but no change was reflected in the 'Loan Status' screen which would show last month's status. Thus, while the app did provide more updated and precise information on overall loan status and status of the three buckets, this information was still not real time, and thus not optimal for field agents-driver interaction at-transaction.

Figure 5. A field agent takes a photo of the bank deposit receipt to send it to the back-office via the app.

5. DISCUSSION

In this section, we will discuss the overall changes introduced by the app along with the back-end system in the monetary ecology of loan payments, and highlight some insights arising thereof.

Our case illustrates the point made earlier that financial transactions ought not to be conceptualized through the atom of P2P relations, since the 'P's and '2's may have various forms and are part of a larger ecology. In our case, P2Ps and B2P between TWU-drivers-field agents-banks entail quite different actors and relations: As for the 'P's, the 'drivers' may not just be specific persons but could be family members or friends; drivers' relationships to TWU are both of P2P and P2B, since they interact with field agents as well as the TWU organization. As for the '2's, the relations between the various parties are mediated through different artefacts: Driver-field agent relations are mediated through the app (for making calls, recording payments etc.) and, for now, use of paper ledgers and passbooks, and takes the character of field agents counselling, monitoring and persuading drivers to stay on course. Field agent-TWU relations are mediated through the app/back-end and is one of employment, supervising and approval. The various transactional flows and the use of paper and digital artefacts should be understood against the broader ecology of loan payment, as illustrated in the figures (6) and (7) below.

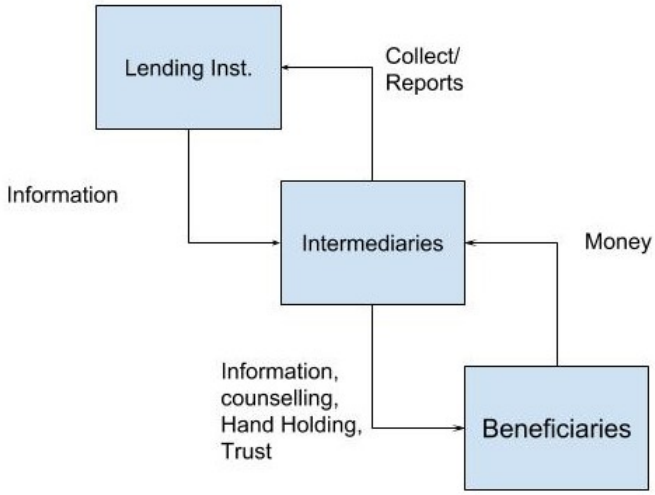

Figure 6. A variant of a general model of financial service delivery for low-income groups

Figure 6 shows a version of a general model for financial service delivery for low-income groups prevalent across the globe [6, 14, 17, 25, 28, 29, 32]. Several variants of this model involving different actors and some or all the elements specified exist. In the context of financial products and services for low-income groups, first, there is the financial institution. This can be a bank, a non-banking financial institution, a microfinance institution, or even private individuals. Since our focus is on lending and credit, the financial institution in our version of the model is a lending institution. Mainstream lending institutions, such as banks, do not lend to low-income groups because of the risk of default, lack of credit rating, and high costs of service delivery [6, 13, 16, 24, 29, 32]. Intermediaries seek to fill in this gap and become a bridge between the low-income beneficiaries of financial services and the financial institution. These intermediaries, again, can be individuals, retail agents, collectives such as savings clubs, self-help groups (SHGs) and so on. However, even where the lending institution is directly lending to low-income communities, for example in the case of microfinance organisations, human intermediaries play a core role in these interactions (unlike more in mainstream banking where lenders and borrowers may have little human contact once the loan has been given). In the case of microfinance organisations, the intermediaries are often employees of the organisation. However, they carry out a similar function. That is, these human intermediaries provide information about financial services and products (in this case, loan) to the beneficiaries, engage actively in handholding, provide financial counselling, work with them in repaying their debt, and motivate them to

engage in savings. They are the key point of contact and it is their relationship with the borrowers that is crucial in engendering transparency and trust in the entire system. The intermediaries, in the case of lending, collect payments from the beneficiaries and pay them to the lending institution on their behalf, maintaining records of all transactions[2]. Both lending institutions and beneficiaries are, therefore, highly dependent on the intermediaries for the entire ecosystem to function well.

The lending institutions, once a loan is approved, are mostly concerned about the repayment rate thereafter. So long as they receive the required amount on time, they do not bother with the how's of it (for instance, how to persuade and cajole the beneficiaries not to accumulate any backlogs, how to ensure timely payments and so on). It is this relatively 'hands-off' behavior of the lending institutions that provides the intermediaries the required leeway to help the beneficiaries manage their finances. Such maneuvering can entail restructuring the loan into small payments with flexible schedules, as the beneficiaries often earn small, irregular incomes. Any financial product, service, technology or tool that aims at catering to the needs of low-income groups, irrespective of the context, must grapple with this fundamental reality.

Where intermediaries play a pivotal role is in exercising their skill, discretion, empathy, and judgment in helping the low-income beneficiaries manage their finances. In the context of debt, these intermediaries need to exercise great discretion in evaluating whether a missed payment is genuine or not, why certain individuals or households might be falling behind, in what ways they can be helped, and so on. Loan repayment, across low-income contexts, can be modelled as a triad involving three main axes, namely: amount paid, frequency of payment, and size of backlog accumulated.

The intermediaries' willingness and ability to incorporate flexibility in payments is shaped by these three factors. If the backlog is small, then the intermediary can be flexible either with the amount or the frequency of payment. If the amount paid is high, but frequency is low, then huge backlogs will likely not be accumulated. Conversely, if the amount paid is small, but frequency is high, then also chances of accumulating backlogs will remain low[3]. Where substantial backlogs have been accumulated, the intermediaries must persuade the beneficiaries to repay as much as possible and as often as possible. The higher the backlogs, the less room for flexibility as the risk of default looms large. The key insight here is that any loan product or tool designed for low-income groups must allow for this flexibility and exercise of judgment by the human agent(s) involved. Fixed schedules (by amount and/or frequency) will not work nor will such an imposition be 'collaborative'. The workarounds the field agents engaged in illustrates this. Collaboration involves activities undertaken together in the pursuit of a shared, task-based goal (Luff et al). In this sense, even though the three parties – lending institution, intermediaries, and beneficiaries – are not in a symmetrical power relation with each other, they are still engaged in managing debt and finances collaboratively. This opens novel opportunities and spaces to view work as 'collaborative' even in the context of unequal power relations.

[2] In other contexts, such as self-help groups and savings clubs, intermediaries, external or internal, help to accumulate resources from community members, aid them in saving for emergencies and long-term expenses, as well as disburse the pooled resources as micro-credit to those members who need it [2, 6, 34, 39].

[3] However, given low-income groups experience uncertain, daily incomes, it is considered good practice amongst MFIs and other institutions catering to low-income groups to encourage smaller, frequent payment schedules.

Physical and digital infrastructures, with their distinct affordances, enable and constrain certain forms of action. This, in turn, enables us to examine (inter)dependencies and opportunities for redesigning to enhance users' agency and control. These do not merely influence the logistics of the payment transaction, but also how the entire monetary ecology around it evolves. In most ecologies, as in ours, there remain a mix of paper and digital artefacts: While digitization does enable immediate relay of information on several fronts, and thus, could save time and costs for the beneficiaries and intermediaries involved, paper-based artefacts are still used to carry out their moneywork in addition to using digital technology. In our case, for drivers, the passbooks were their key documentation of loan payments; for field agents, ledgers were maintained to facilitate information retrieval independently of the app. Since the information on the app was not entirely up-to-date along various fronts, maintaining ledgers enabled them to retain some control over the work processes and also maintain trust with their drivers.

Paper artefacts, notwithstanding their numerous affordances, pose challenges for remote collaboration and open space for inconsistencies and duplication of efforts. This is where digitization brings benefits. With a unified data management system whose front- and back-ends are tightly integrated, it enables (or *should* enable) a relay of information back and forth between the different stakeholders involved in real time. Such a tight coupling helps overcome the limitations of paper artefacts by creating a digital trail. In other words, digitization can enable traceability of transactions and lays bare any potential for misuse or abuse, which can then be fixed. It also provides a wonderful opportunity to create a durable, digital footprint for low-income groups. There is a contention often made that a credit rating is a prerequisite for financial technologies to be beneficial for the poor. However, an alternative is to work-around the lack of credit ratings, as is done here, and then once done to use the digital record of loan payments as a way to build a credit rating. That is, TWU used social relationships via referrals and regular meetings with drivers as a credit rating proxy to get people onto the system initially. Once on the system, the digitization of payment records, alongside call history, can be used to create a financial history and build a credit rating. This will go a long way in achieving their financial inclusion.

Digitization not only helps to establish a digital footprint for the beneficiaries, but it also helps unravel the issues prevalent in the design of loan products for low-income groups. Digitizing the ecosystem helps identify the inaccuracies and inconsistencies easier as compared to a paper-based system. The first step in solving any problem is recognizing that one exists. Our study corroborates findings reported by previous studies that most MFIs and SHGs operate with a mix of paper based and digital records which results in lot of data being replicated, redundant and inconsistent [34, 39]. Our experience showed that once a transition is made to a digital system, it results in the same inconsistencies being reflected there, which now becomes easier to identify and fix. It is important, therefore, not to view 'breakdowns' or gaps between expectations and actualities as an indication of failure. Rather, they ought to be viewed as symptoms illuminating larger problems or concerns that require scrutiny.

In addition, digitization can help make the work of different actors 'visible'. In the pre-app workflow, where the front- and back-end work processes were loosely coupled, the beneficiaries were privy mostly to the front-end work processes like field agents' bookkeeping practices. In the post-app workflow, the post-transaction work done by field agents and the back-office is now

visible to the drivers, in real time. It now puts the onus on the actors in charge of the back-end system to get the different aspects of the workflow correct (for e.g. loan figures and contact numbers being up-to-date) by empowering the beneficiaries to prompt for information about their loans and obtain it immediately. Technology, thereby, supports awareness, stimulating reflection on the part of beneficiaries on managing their finances in the short- and long-runs. Providing key feedback at such 'teachable moments' can help them to stay motivated and pay off their debt on time. This is a key intention of this intervention.

	Pre-Transaction	At Transaction	Post Transaction
BEFORE	**Driver**: Cash/Check + Book **Collector**: Ledger	Exchange Cash + Book Entry	SMS (Same Day; Manual) + Deposit Money to TWU's Account + Submit Receipts to office(Manual) + Verify Collections + Deposit money to drivers account
AFTER	**Driver**: Cash + Book + Phone **Collector**: Phone **System**: Up to date data	Payment Schedule(Optional) + Cash + Record PIN + Update/New PIN (Optional) Workarounds(Optional) + Book Entry + SMS(Auto-generated)	Deposit Money to TWU's Bank + Send Deposit Receipt Picture via App + Verify Collections + Deposit money to drivers Account

Figure 7. A pre-, at-, and post-transaction process or flow chart mapping the pre- and post-app TWU workflows.

At the same time, the complexity and heterogeneity of 'intermediaries' involved also gets unpacked. Intermediaries, in the model laid out, are not a unitary entity or actor. They can be diverse actors working in tandem. In addition, visibility of work done by the intermediaries, and visibility of how beneficiaries are faring with their loans and indications of who needs support and so on, will go a long way in enhancing the accountability of intermediaries (both human agents as well as organizations and self-help collectives) and the work they do. Schauer [37] makes a distinction between 'passive' and 'active' transparency, arguing that simply making data available will not suffice by itself, but an organization needs to actively communicate and interpret it with its agents and beneficiaries [19]. Technology can help create such an ecosystem by constituting a communication channel between the different actors in the monetary ecology.

That said, in a context where interpersonal trust supersedes institutional trust, it is important to make sure that the systemic design does not disrupt the relations and the trust that is in place between the different stakeholders involved. At the same time, interpersonal trust is not something that can be explicitly designed into a payment system (which [46] also note). Trust evolves organically and is a precondition for financial collaboration (both co-present as well as remote) between people. While it might sound counterintuitive, at least when compared to

mainstream banking and payment systems design thinking, it is also important to think about *non-design* as we do about design implications. As [46] argue, there is a tendency in computer science and allied domains to find applications for digital technologies without enough consideration for their suitability in a given context – what [44] calls 'technological utopianism'. It is, therefore, crucial that we are critical and reflexive about what *not* to design and where *not* to introduce technology just as we think about what and how to design and where to apply technology.

User Control-System Dependency Trade-off

One major change, with the introduction of the app, is that the back-end system becomes significant in the pre- and at-transaction phases of moneywork cycle, because it now controls all the information and shapes the entire workflow. Information on beneficiaries, their payments, status of debt etc. are all now dependent on the back-end system providing up-to-date information for the app, as well as on the verification of payments post-transaction. This has implications for the pre-transaction work (e.g. list of beneficiaries to manage on the system), at-transaction work (e.g. recording payment on the app, information on loan), and post-transaction work (e.g. ensuring amount of payment matched between receipts and the app, all payments correctly recorded and deposited at the bank). Thus, while it streamlines the different work processes and potentially mitigates duplication of records, the app entails new forms of work in different phases of the transaction for the involved parties [9].

One unintended consequence of the app design was that control shifted more towards the back-end system in the post-app workflow. We found that the app could not be used as a *communicative tool* to convey grievances. One overall design change with the app, therefore, that would seem desirable from the point of view of beneficiaries and front-end intermediaries would be to enable updates of information to be a two-way traffic: just as changes made in the back-end are reflected in the app, the app should enable changes to be pushed from the app to the back-end. The primary users of the app should be able to push for updates and changes, and those in charge of the back-end system should be delegated to more of a supervisory authority. This would enhance the primary users' agency and supporting the work they do, with the app becoming closer to a mediating tool between the front-end and back-end processes, which was the original intention.

Visibility-comprehensibility trade-off

This study also revealed a second unintentional consequence of the app. The field agents and collectors wanted the 'Loan Status' figures to be updated in real time (like the 'Payment History'), since this would enable drivers and field agents to see and discuss loan status during the transaction. However, technically it is not possible to do this accurately, because of the post-transaction workflow. That is, each payment drivers make is allocated between three buckets (main loan, SDL, and TWU fees). Because few drivers pay the right amount at the right time, the allocation decision is not simple. At the moment, it is done on a monthly basis by a loan allocation algorithm which is then checked by the loan officer in the back office. When this allocation is done, the money is transferred from TWU to the bank. However, since drivers are paying by cash, there is a delay in the process between field agents collecting the money, depositing it in TWU's bank account, and then TWU allocating the money between the different

buckets. What is interesting here is that the app has made TWU's back office processes *more visible* to the drivers (and field agents). However, this visibility is what causes confusion. Previously drivers had no information on an immediate basis about when and how their payments got allocated between the various buckets, so the delay did not matter. Now they have information but neither they nor the field agents understand it fully, nor should they have to. However, this partial visibility into back offices processes leads to a lack of trust in the system, meaning the field agents do not share the screens as intended and therefore miss out on teachable moments. One solution, albeit an imperfect one, might be to show the money allocated to the buckets as the loan allocation algorithm suggests, with the disclaimer that 'funds that are not cleared might change'. A second, also imperfect alternative, is to show only one single bucket for the total loan, which could indeed be updated in real-time. Perhaps what is lost in transparency (i.e. the information on how TWU is allocating the drivers payments between buckets) would be made up for by gains in comprehensibility.

Regularity-Flexibility Trade-off

TWU's experience led its management to wish to get drivers to pay more frequently so that they do not accumulate backlogs and any backlogs will be manageable. However, field agents reported that it was difficult, if not impossible, to convince (at least the existing) drivers to alter their payment practices from monthly to weekly payments. As a result, the weekly 'Payment Schedule' functionality was used arbitrarily by the field agents. This also cluttered the 'Call' tab because drivers paying once a month would show up every week, which made it difficult for the field agents to follow up.

The 'Payment Schedule' feature can be redesigned in such a way that the drivers/field agents can choose between weekly and monthly schedules, depending on their payment practices. A calendar can be used to set up a monthly schedule and the date agreed upon between the field agent and driver can be thought of as the deadline before which drivers have to pay. For drivers who are already paying weekly and those who want to pay once a week, the weekly schedule can be used. This change, coupled with allowing field agents to make modifications to the list of drivers as well as update their contact information, will also ensure that the 'Call' tab is not cluttered but contains only those drivers who are to be followed-up. Pop-up dialogue boxes like alarm clocks can be implemented as well, like one of the field agents requested, to serve as reminders for follow-up.

The PIN system, which was an enforced work process, did not work as intended for reasons discussed above, illustrating a 'design-actuality gap' [12]. The PIN was intended to ensure that field agents would bring their mobile phone to the transactions and use the app in the presence of the drivers, since it was needed for the field agents to record payments. This was envisioned as an opportunity for the drivers and field agents to check upon the payment history at-transaction together. In practice it was observed that almost all the drivers ended up giving their PINs to their respective field agents, because of the interpersonal trust in place. Whilst this was expected, what was not expected was the one field agent who used this to completely work around the system and not carry her phone at all. In other instances, the PIN caused extra at- and post-transaction work, since drivers forgot it, in which case a new SMS had to be generated in-situ, and because drivers let family members or friends take care of payments without providing them with the PIN. Since, the trust entailed in sharing PIN between driver and field agent cannot be

assumed to exist necessarily in all future cases, and because of extra work involved in generating new PINs in cases of forgotten or not-available PIN, it is tempting to engage in new designs for ensuring confidentiality and easily generating password at-transaction. Options could be one-time passwords (OTP), universally unique identifier (UUID) for payments, or other solutions. However, these solutions also have drawbacks. For example, OTP like the PIN require the driver (actually his mobile phone) to be present. There is a case for retaining the existing PIN system in favour of these alternatives, since the existing PIN allows drivers to share it with family members or friends and allow them to be in control of payments. Similarly, a practical solution to the non-presence of drivers would be to inform drivers to write down their PINs in their passbooks and remember to leave these with the person making the payment on their behalf. In addition, family member's phone numbers can be added on the system and thus receive new PINs in case these are not available.

6. CONCLUSION

At this stage, where the app has just been implemented, it is too early to assess and deliver a verdict upon the long-term effects of digitizing financial transactions and financial inclusion. What the case does show is that digitizing financial transactions and introducing mobile technology changed the monetary ecology in important ways. The app, together with the backend system, transformed the processes involved in loan payment workflow from disparate artefacts which provided little support for beneficiaries and intermediaries into a more coherent, accurate, up-to-date integrated system. The app also provided the opportunity for updated information to be available at-transaction.

The front-end and back-ends of the ecosystem became more tightly coupled which entailed a crucial role for those in charge of the back-end system, since it controlled the updating and verifying information. Ideally, this ongoing digitizing of the ecology of monetary transactions will achieve the aim of improving the involved actors' situation: Field agents work is supported by the app and enables them to handle more drivers and strengthen their role as 'financial counsellors'; drivers may succeed in completing their loans and become owners of auto rickshaws more likely. TWU as a social, for-profit organization, obtains a more efficient administration, can grow and increase the number of drivers and field agents they support, and thus overall work towards improving drivers' and field agents' lives. However, as we have shown in the discussion of the 'P's, '2's, of the changes in the monetary ecology, and suggestions for design implications, digitization does not do it per se, and much relies on the specific configuration of the system.

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