

Cellfare: Delivering Self-Targeted Social Protection Using Mobile Phones¹

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Abstract

This paper proposes a new form of self-targeted social protection scheme: beneficiaries carry out a series of small tasks on their mobile phones, each linked to a small payment. Key advantages over traditional public works include potentially large reductions in leakage, costs and delays. The proposed scheme may also be suitable to wider demographics as it does not require physical labour and can be availed from home. A prototype implementation of a 'cellfare' scheme was tested in rural India, and 42 participants with experience of the National Rural Employment Guarantee, a large Indian public-works programme, favourably compared the proposed scheme to the existing one.

Keywords

Social protection; self-targeting; mobile phones; public works; workfare; NREGA; India

1 Introduction

This paper proposes an innovative form of social protection that has the potential to be more inclusive of certain categories of potential beneficiaries than traditional public works. At the same time, the proposed scheme retains a key feature of public works, namely self-targeting: the intention is to discourage use by those who do not need it. It also has the potential to reduce costs relative to traditional public works.

A key problem in social welfare design is targeting, that is, how to ensure benefits reach the intended beneficiaries.² In rich countries, targeting often relies on screening, that is, defining a set of eligibility criteria and assessing potential beneficiaries against them. But in developing countries, the information required to assess the eligibility of potential beneficiaries can be costly to obtain and prone to error and fraud.

An alternative to screening is to make benefits self-targeted, that is, to make them unattractive to those who do not need them. The leading example of self-targeted social protection is public works:³ the provision of benefits in return for labour. Public works differ from regular employment in that the primary aim of the employer (usually

¹ We are grateful to Tim Besley, Ollie Ramsey, Jon Temple and two anonymous referees for useful comments. Ethical approval for this project was provided by the University of Bristol.

² Making benefits universal — available to everybody — avoids the problem of targeting, but is costly if the aim is to help the neediest. See Besley (1990) for a discussion of this trade-off.

³ The term 'workfare' is sometimes used synonymously.

the government) is to transfer resources to workers who would otherwise be unemployed, rather than to use the labour as a productive input, although the latter is typically a secondary objective. Public works amount to a self-targeted welfare scheme if anyone can sign up, while the conditions and pay on offer are unattractive to those who can find a normal job.

Traditional public-works programmes have several disadvantages (Ravallion 1999, Subbarao 1997, Subbarao 2003). First, administration costs can be large. The physical projects need to be scoped out, planned and managed, and there are costs related to worker enrolment and payroll management. Second, non-labour operating costs, such as transport, materials, machinery and site supervision and facilities can consume a large proportion of the budget. Third, public works have been associated with leakage due to fraud on the part of officials and managers as well as workers. Fourth, there can be substantial delays in work provision, since it is difficult to plan and locate projects to coincide exactly with fluctuating demand from workers. Fifth, there can be delays and errors in payment. Sixth, traditional public works often involve outdoor manual labour, so it is typically best suited for those who are physically fit and, in some cultural contexts, male.

The core idea presented in this study is that by offering and rewarding micro-tasks via mobile phones as a form of social protection, many of the disadvantages of traditional public works can be mitigated. Administration of the 'cellfare' programme could be centralised and largely automated. Operating costs would be transparent and almost exclusively derive from mobile network charges and transfer fees. The scope for at least some forms of fraud would be reduced by eliminating intermediate layers of administration and by making all reporting automatic, accurate and immediate. Cost savings could be channelled to the construction of public assets, such as roads, using more efficient means – skilled contractors and machinery rather than unskilled labour. The scheme could be made entirely on-demand — available at all times and for any duration — or it could be 'switched on' at times or in regions of need. Each submitted micro-task could be automatically verified and rewarded by mobile transfer directly to the worker, taking advantage of the rapidly expanding mobile payment networks around the world. While some categories of disabled people (e.g., the blind) may still be excluded, the proposed scheme is likely to be accessible to a broader set of beneficiaries.

We present the results of a prototype implementation and field test of the scheme in rural Karnataka, India. Forty-two test participants all had experience of working under the National Rural Employment Guarantee (NREG), the world's largest public-works programme (Sukhtankar, 2017). After working on mobile phone-based micro-tasks for 1–3 hours, the participants were asked a series of questions comparing the proposed scheme to NREG. The phone-based scheme compares favourably to NREG in many dimensions. For example, based on this brief exposure, sixty per cent of participants consider the work offered under the proposed scheme more dignified, and about half state that they would prefer it over NREG if they had to choose one. While the sample is small, the exposure was brief and several aspects of the scheme would need to be modified before it could be implemented at scale, these preliminary results suggest that the user experience is at least not dramatically

worse than that of existing public-works programmes. A larger-scale implementation would be required to compare administration costs, fraud and access to existing schemes.

As far as we know, this is the first paper to propose a self-targeted welfare scheme based on mobile-device micro-tasks. There have been previous attempts to make commercial work available to low-income workers in developing countries using mobile phones (Eagle, 2009; Narula et al., 2011; Gupta et al., 2012; World Bank 2021). But the context of social protection means that the tasks offered need not have any commercial or social value. One can instead focus on designing tasks that are instantly verifiable, available to all — including those without qualifications and the illiterate — and paid at a low enough rate to be attractive only to those who need it. Still, productive work is not ruled out.

The economic analysis of self-targeted welfare schemes goes back at least to Nichols and Zeckhauser (1982), who argue that targeting can be achieved by the imposition of pure deadweight costs (an ‘ordeal’) on beneficiaries. Ravallion (1991) discusses self-targeting in the context of the Maharashtra Employment Guarantee, a precursor to the National Rural Employment Guarantee. Besley and Kanbur (1991) compare workfare and transfers in kind as two forms of social welfare that may incorporate elements of self-targeting. Besley and Coate (1992) analyse welfare programmes with work requirements and distinguish between the screening (targeting) and deterrent arguments for workfare, where the latter stems from the notion that ordeals may be required in order to incentivise agents to exert effort to avoid poverty. There are also a small number of empirical papers looking at the extent to which schemes are, or can be made, self-targeted. Jacoby (1997) provides evidence of self-targeting by finding that poorer households were more likely to enrol in a programme that distributed a bland snack to students in Jamaica. Alatas et al. (2016) find that increasing the cost of applying for a welfare scheme can make it self-targeted by discouraging richer applicants.

2 Digging (digital) holes and filling them in

In order to function as a self-targeted welfare scheme, the work that is offered must be suitable for unskilled labourers. The tasks should be designed in such a way that virtually anyone can complete them. In particular, literacy, schooling or professional qualifications cannot be required. At the same time, the work should command a beneficiary’s full attention, so as to screen out those who are employed elsewhere.

By contrast, from a mechanism design point of view, the quantity and quality of goods produced under the scheme are of secondary importance. Indeed, in the basic implementation described next, the work is completely unproductive. While not physically arduous, the micro-tasks in this implementation thus function as ‘ordeals’ in the sense of Nichols and Zeckhauser (1982).

While the possibility of offering productive work will be discussed below, the unproductive scheme serves as a useful benchmark. From a cost point of view, it is to

be preferred over the traditional scheme if the associated cost savings exceed the value of the goods produced by the latter.

3 The National Rural Employment Guarantee

As a benchmark for the proposed scheme, consider India's National Rural Employment Guarantee (NREG), the world's largest public-works programme. It aims to provide up to 100 days of guaranteed wage employment per year to any rural household whose adult members are willing to do unskilled manual work. NREG beneficiaries work on projects aiming to promote natural resources and create rural infrastructure. Introduced in 2006 and expanded to all rural areas of India in 2008, NREG provided employment to over 42 million households in 2015–16, and its budget for that year represented 0.3 per cent of India's GDP.

NREG has been successful in providing some measure of employment security. By pushing up wages for casual rural labour (Berg et al., 2018), it has arguably had a beneficial effect even on those agricultural workers who do not directly participate in it. However, the proportion of participating households who obtained 100 days of employment declined from 14 per cent in 2008–09 to 6 per cent in 2015–16, even though Dutta et al. (2012) document considerable unmet demand for work in all the states of India, and especially in the poorer ones.

Unfortunately, NREG is notorious for corruption. Over-reporting of person-days worked and pocketing the associated budget (Berg et al., 2013) is one of the most common forms of embezzlement by involved officials. In its early years, Imbert and Papp (2011) estimated that across India, only between 42 per cent and 56 per cent of reported person-days of employment under the scheme represented actual work. There is evidence that access to scheme is rationed, suggesting administrative discrimination (Narayanan and Das, 2014; Sukhtankar, 2017). There are also substantial genuine administration and operation costs.

While there are few reliable estimates of the value of goods created under the scheme, the World Bank (2011) observed in the context of NREG that 'the objective of asset creation runs a very distant second to the primary objective of employment generation.'

NREG work is typically not suitable for beneficiaries unable to undertake physical labour, nor for those who for any reason need to work from home.

4 A basic implementation and field test

This section presents details of a specific, basic implementation of the proposed scheme and results of its field test. The implementation described here should be thought of as a prototype. Several aspects would need to be modified if it were to be scaled up into policy.

4.1 The basic implementation

The prototype was implemented as a server issuing micro-tasks to users by SMS. Correct answers would be rewarded by increasing the user's earned balance, and a new task would be issued. The earned amount was paid out to the workers at the end of the session.

A new user would initiate a work session by sending an SMS (for example, 'Start') to the server's mobile phone number. This triggered a response with the first task:

Welcome! Your balance is 0 rupees. To earn 1 rupee, reply with the reverse of this number: 4321

(The actual number task was randomly generated.) If the beneficiary replied with the *correct* answer ('1234' in this case), the service would respond with:

Correct. Your balance is 1 rupee. To earn 1 rupee, reply with the reverse of this number: 8765

On the other hand, if the answer was *incorrect*, the reply from the server would be:

Incorrect. Your balance is 0 rupees. To earn 1 rupee, reply with the reverse of this number: 4321

Thus each reply, whether correct or incorrect, would trigger an automated reply with the updated balance and a new or repeated task.

The maximum frequency of tasks issued by the server was set so as to cap earnings at approximately the level of NREG pay. At the time of the field test, the regulated pay for NREG work in Karnataka was 243 rupees (USD 3.74) per day. Assuming an effective working day of six hours, this rate corresponds to about 40 rupees per hour, or 1 rupee every 90 seconds. The system would, therefore, reply to workers' messages immediately if the previous task was sent more than 90 seconds earlier, but otherwise wait until 90 seconds had passed.⁴

⁴There were minor variations in the scheme between the four test sessions. The changes were made partly to make the work easier and fairer. The 'task' was 5 digits long in the first and second sessions, 4 digits long in the third session and 3 digits in the fourth session. In the first session, tasks were remunerated at 0.70 rupees and the maximum rate was one task every 60 seconds, whereas in later sessions tasks were remunerated at 1 rupee and sent at a maximum rate of one every 90 seconds. Initially, new tasks were sent whether the worker's response was correct or not, but in later sessions the same task would be repeated until it was 'solved' correctly by the worker. Finally, in the first sessions the system would space out responses to both correct and incorrect messages, whereas in the later sessions responses to

4.2 Recruitment, workers and payment

The basic implementation described above was tested in April 2017 in Karnataka, India. In four villages in Kolar district, households were randomly selected and contacted. They were asked whether any of the household members had worked under the National Rural Employment Guarantee (NREG). Potential participants also needed to be able to access a mobile phone — they could use their own or borrow somebody else's.⁵ We required participants to have some experience in using mobile phones for making and receiving calls, but we did not require experience with SMS.

Those satisfying the criteria were invited to attend a work session held in a communal space in their village a few days later at a specified time. They were told that they would be paid a flat participation fee of 100 rupees for a session lasting 2–3 hours, plus any earnings from the work. In addition, participants were given mobile phone credit to cover their SMS expenses.

Of the 100 people invited across the four villages, fewer than half turned up. There may have been an issue of trust, as our field workers were not known to the villagers. Potential participants may also have lacked confidence in their own ability to do the work. (They did not know the details of the work at the time of recruitment, but they were told that they would be paid for an SMS-related task.) For these reasons, our data may not be representative of the population of NREG workers, but they should suffice to give an idea of some potential beneficiaries' first impressions of the scheme.

Nearly all participants had a basic (non-smart) mobile phone and would use a pen and paper (provided by us) to note down the task and solution before keying in their response.

As the focus of the field test was on the work itself rather than the disbursement system, participants were paid their earnings in cash at the end of the session rather than by mobile transfer. Payment by mobile would also have been impractical because some participants did not own a mobile phone but had borrowed one for the session.

incorrect answers were sent immediately and the minimum spacing only applied to responses to correctly solved tasks.

⁵In the 2011 Census, 48% of rural households and 63% of urban households in India owned at least one mobile phone. Mobile ownership has expanded significantly since then. Anecdotally, a large proportion of households who still do not have their own mobile phone are able to borrow one when needed. In the setting of the field test described here, only 6% of those we contacted and who did not take part in the study gave as their primary reason that their either did not have access to a phone or did not know how to use one. So while some potential beneficiaries may be excluded from the scheme by not having access to a mobile phone, this excluded category is small and shrinking.

4.3 Findings

Forty-two participants with NREG experience took part and are included in the analysis.⁶

There were four work sessions. In each session, after a general introduction explaining the purpose of the research and the nature of the tasks, enumerators would re-confirm consent, field a pre-session survey and then help participants get started by sending the initial message to the server. Since not all participants arrived at the same time, and since they required individual enumerator attention for the survey and to launch the first task, the effective start time for the work varied within a session. At the end of the session, some participants would keep working while others were fielded the post-session survey. A small number of participants chose to leave before the end of the session, and these were fielded the surveys and paid in the same manner as the others.

Summary statistics are presented in Table 1. Forty-three per cent of participants self-identity as belonging to a scheduled caste or tribe. Twenty-nine per cent are women. The age range is from 18 to 73 with a mean of 45 years. Thirty-eight per cent are illiterate. The number of years of schooling varies between 0 and 15 (there is one university graduate in the sample), with an average of about five years. Seventy-nine per cent are married. The principal occupation of the household is 'agricultural labourer' in 55 per cent of cases, and 'cultivator' (meaning they primarily work on their own land) in another 31 per cent. Fourteen per cent of participants used smart phones. The number of days of NREG work undertaken over the past 12 months ranged from 5 to 180 with an average of 36.⁷

The duration of the work session, as measured by the gap between the first and the last server message, varied from about half an hour to more than six hours. However, nobody actually worked for more than about three hours, and the longest duration observations are due to some SMS messages being delayed by the mobile network. The average work session was about 105 minutes long, and only three work sessions were recorded as lasting more than three hours. The number of tasks completed correctly in this time varied between 0 and 65, with an average of 17. Two respondents did not complete any tasks correctly, and the minimum number of completed tasks among the remaining participants was three.

From the duration, the number of tasks completed and the piece rate, it is possible to work out an effective hourly wage. This ranged from 0 to 34 rupees, with a mean of about 9. (This excludes the 100 rupees show-up fee paid to all participants.) If the two participants with zero completed tasks are excluded, the mean hourly wage is about 10 rupees. These figures are far below the NREG rate of about 40 rupees per

⁶ In one additional case, the participant did not actually have NREG experience, and in two cases we were unable to match the phone number provided in the survey with the number recorded by the server.

⁷ These numbers are self-reported. While it is possible that someone has worked 180 days in NREG over 12 months, it would be uncommon. The NREG entitlement is for up to 100 days per year, and the second highest observation in the sample is 100.

hour. To get closer to the NREG rate, the tasks could be made easier, for example by using tasks with two digits rather than three, four or five. It is also quite possible that the rates would have picked up over time as the participants became more comfortable with the tasks and the technology.

At the end of the session, participants were asked a series of questions contrasting 'SMS work' to 'NREG work'. For each question the answer options were 'SMS work', 'NREG work', 'No difference' or 'Can't say'.⁸

The results of this poll are presented in Table 2. A majority of participants found SMS work less difficult, more comfortable, more convenient, less physically tiring, more dignified, better for building self-confidence, better for building experience to get other work and more likely to teach them something new. At the same time, SMS work was perceived to be more mentally tiring than NREG work.

A little over half the participants thought NREG work was more suitable for healthy, working-age men and women, and 83 per cent thought NREG work was more suitable for the illiterate. A large majority of participants thought SMS work would be more suitable than NREG work for women who are pregnant⁹ or who have small children, the elderly, those in poor health and the disabled.

Only 10 per cent thought SMS work was better for the overall development of the village. This is likely because many NREG projects aim to build or improve local infrastructure, while the proposed scheme, at least in the implemented form, is unproductive. However, it may not have been clear to the participants (and it was not explained to them) that the savings from reduced administration costs and leakage could be spent on developing local infrastructure in a more efficient manner.

Finally, participants were asked which type of work they would personally prefer, if that had to choose only one. Fifty-one per cent responded that they preferred SMS work. Recall that the respondents were experienced NREG workers; if we had asked the population at large, the proportion preferring SMS work may well have been larger. This is consistent with Alik-Lagrange and Ravallion (2018), who argue that the disutility of working in NREG is considerable and should be taken into account when evaluating its effects.

These results are based on a small and selected sample of rural workers who tested the prototype scheme only for a fraction of a day. Still, by and large, it would be fair to say that the idea of 'SMS work' was acceptable to these potential beneficiaries. A majority of workers found SMS work preferable in many respects, and about half would prefer it over NREG work if they could choose.

⁸ Very few chose the latter two options (a maximum of three respondents per question), so the focus will be on the proportion who responded 'SMS work' out of those who stated a preference, that is, out of those who responded either 'SMS work' or 'NREG work'.

⁹ However, one female participant felt that NREG work is more suitable for pregnant women as physical labour would facilitate normal delivery.

5 Considerations for scaling up

The basic implementation described above is intended as a proof of concept and would need to be modified in several ways to be scaled up. Operating an unproductive scheme, such as the one piloted here, makes it possible to generate tasks with known 'solutions' that can be automatically and reliably verified. Still, being able to offer productive tasks would have several advantages, including the possibility of partly or fully financing the scheme by offering the services of the workers to paying clients.¹⁰ It may also make the scheme more politically feasible. On the other hand, this could limit the availability of work since there may be a limited supply of suitable tasks and clients willing to pay for them.

Even if the work is not commercially viable, it might contribute to a public or social good. One possibility would be to make the tasks educational. A scheme in which the payments could be viewed as investment in human capital could be socially beneficial and perhaps more politically palatable.

If the proposed scheme were to be offered at scale, a concern would be that a system could be developed to 'milk' the scheme by automating task completion. One solution to this threat is to include tasks that only humans can solve effectively. 'Captchas' ('Completely Automated Public Turing tests to tell Computers and Humans Apart') are used in contexts where an application needs to verify that a user is human as opposed to a computer programme. Some captcha systems also do useful work.

A related concern is the possibility of human outsourcing — rather than doing the work him/herself, the mobile phone owner would employ someone else to do the work in return for part of the revenue. While some money would still reach the worker, this is wasteful from the planner's of view. However, if the entry cost (the cost of the mobile phone) is sufficiently low relative to potential earnings, this is unlikely to be a serious issue, because it would be more profitable to work for oneself than for somebody else.

It may still be a concern that the work is done by other household members (for example, children) rather than the registered beneficiary. A smartphone-based implementation may be able to get around this problem by integrating regular biometric authentication (fingerprint scans) of the registered user.

The proposed system is only truly self-selecting if it involves some level of foregone earnings. If someone chooses to use the system in their spare time, it may be additional to other work, and self-selection may break down. While it would hard to completely avoid this, we would propose that the issue can be partly circumvented

¹⁰ Previous work has looked at the possibility of outsourcing, or 'crowdsourcing', certain types of microtasks to workers in developing countries using mobile technology (Eagle, 2009; Narula et al., 2011; Gupta et al., 2012). However, these systems were generally aimed at generating employment rather than providing social protection. A recent initiative offers digital work to young Africans to support geographical data collection (World Bank 2021).

by only making the scheme available during standard working hours, say, 9am to 5pm, Monday through Friday.

6 Final thoughts

This paper proposes a new form of self-targeted social protection: paying beneficiaries to solve micro-tasks via mobile phones. The scheme could be made available to anyone with a mobile phone. It could be made available at short notice, in a specific geographical area, and rescinded instantly if required. It could be accessed by beneficiaries on demand, at no notice. Because the work consists of small, independent tasks, it could be undertaken for as short or long a duration as needed (from a few seconds to several years), and on a part- or full-time basis. In the simplest version, virtually anyone can do it — literacy is not required, though it may be an advantage.

Estimating the cost savings would require a larger-scale implementation, but our results suggest that the user experience of the proposed scheme compares favourably to the existing Indian public-works programme.

Unlike traditional public works, the tasks do not require beneficiaries to have the physical capacity to undertake manual labour. The work can be done from the relative comfort of home, in shade and shelter, or indeed from anywhere with mobile reception. In contrast, traditional public works typically involve beneficiaries spending long hours doing physically demanding work outdoors. The proposed scheme is therefore potentially available to a broader set of demographics including, but not limited to, some categories of disabled and older workers.¹¹

It may be particularly advantageous those (often women) who prefer or need to work from home due to care responsibilities or cultural norms. For example, in Karnataka, India, many women make tobacco products or incense sticks as a form of livelihood. While this work is known to be damaging to their health, they persist because it can be done from home (Rajasekhar et al., 2007).

In contexts where being seen to receive benefits is associated with a stigma, being able to access social protection from the privacy of one's home is an additional advantage. During a global pandemic, in particular, schemes that permit beneficiaries to generate earnings from home might be particularly valuable.

Some may find the idea of self-targeting in welfare programmes objectionable in itself. However, what we are proposing is a digital version of workfare, which has a long history and exists in many countries today. Evidence suggests that there can be a strong preference among the poor for money that is earned rather than handed out

¹¹ Note that we are not arguing for the displacement of specific social protection programmes for those who are unable to work. The proposed scheme is specifically for those who are able to work but cannot find suitable employment.

unconditionally.¹² If the work can be made productive then the dignity argument in favour of self-targeting would be even stronger.

In its basic form, the proposed scheme would provide little scope for learning useful skills to improve prospects of market employment. The work would also be extremely monotonous. However, relative undesirability is a key requirement for the scheme to be self-targeted. Furthermore, it is not clear that these characteristics distinguish the proposed work from what is in practice offered under existing public-works schemes. Implemented versions of the scheme might, however, offer more productive and satisfying work.

Rather than replacing existing workfare programmes, our proposition is that 'cellfare' schemes may be offered as a useful complement.

¹²Dawson and Fouksman (2020) provide ethnographic evidence from South Africa that young unemployed men do not support cash grants for those who are able to work. Survey respondents in Zambia believe those actively seeking work are more deserving of government support (Arthur et al., 2023).

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Table 1: Summary statistics

Variable	Mean	Median	Minimum	Maximum
Scheduled caste / scheduled tribe	0.43	.	.	.
Female	0.29	.	.	.
Age	44.8	43.5	18	73
Illiterate	0.38	.	.	.
Years of schooling	4.7	5	0	15
Married	0.79	.	.	.
Agricultural labourer	0.55	.	.	.
Cultivator	0.31	.	.	.
Smart phone owner	0.14	.	.	.
Days of NREG work last year	35.8	30	5	180
Duration of work session (minutes)	107.9	103.2	31.9	258.9
Number of tasks completed correctly	17.0	14.5	0	65
Implied hourly wage (rupees)	9.44	8.02	0	34.3

Table 2: Comparing SMS work to NREG work: Participant responses

Question	Proportion answering 'SMS work'
Which type of work	
...is more difficult?	12%
...is more physically comfortable?	88%
...is more convenient?	63%
...is more physically tiring?	10%
...is more mentally tiring?	68%
...is more dignified?	60%
...is better for building self-confidence?	53%
...provides better experience to take up other employment?	60%
...would help you to learn something new?	83%
...is more suitable for healthy, working-age men?	44%
...is more suitable for healthy, working-age women?	45%
...is more suitable for women who are pregnant?	86%
...is more suitable for women who have young children?	95%
...is more suitable for the elderly?	90%
...is more suitable for people in poor health?	98%
...is more suitable for the disabled?	100%
...is more suitable for the illiterate?	17%
...is better for the overall development of the village?	10%
If you had to choose one of these two, which type of work would you prefer, personally?	51%

Note: The four answer options for all questions listed here were 'NREG work', 'SMS work', 'No difference' and 'Can't say'. The second column shows the proportion who responded 'SMS work' to the question, out of those who selected either 'NREG work' or 'SMS work'. Few selected the options 'No difference' or 'Can't say' — at most three respondents for any question.