A cost-benefit analysis of *Aadhaar*

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Abstract

This study estimates the costs and benefits of *Aadhaar*. We find that substantial benefits would accrue to the government by integrating *Aadhaar* with schemes such as PDS, MNREGS, fertiliser and LPG subsidies, as well as housing, education and health programmes. The benefits arise from the reduction in leakages that occur due to identification and authentication issues. Our analysis takes into account the costs of developing and maintaining *Aadhaar*, and of integrating *Aadhaar* with the schemes over the next ten years. Even after taking all costs into account, and making modest assumptions about leakages, of about 7-12 percent of the value of the transfer/subsidy, we find that the *Aadhaar* project would yield an internal rate of return in real terms of 52.85 percent to the government.


Contents

1 The question

In recent months, there has been considerable debate about the *Aadhaar* programme. Scepticism has been expressed about whether the expenses of the programme are justified.

By our estimates, the NPV of the expenses required in building *Aadhaar* (and integrating it with the government programmes: Public Distribution System (PDS), Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS), fertiliser and LPG subsidies, education (Sarva Shiksha Abhiyan (SSA) and Mid-day Meal (MDM)), Indira Awaas Yojana (IAY), Janani Suraksha Yojana (JSY), Accredited Social Health Activist (ASHA), Integrated Child Development Scheme (ICDS), pensions and scholarships works out to Rs. 37,186 crore rupees.

Given the magnitude of these expenses, it is important to obtain clarity about the extent to which benefits outweigh costs.

Figure 1 Mapping *Aadhaar*'s benefits
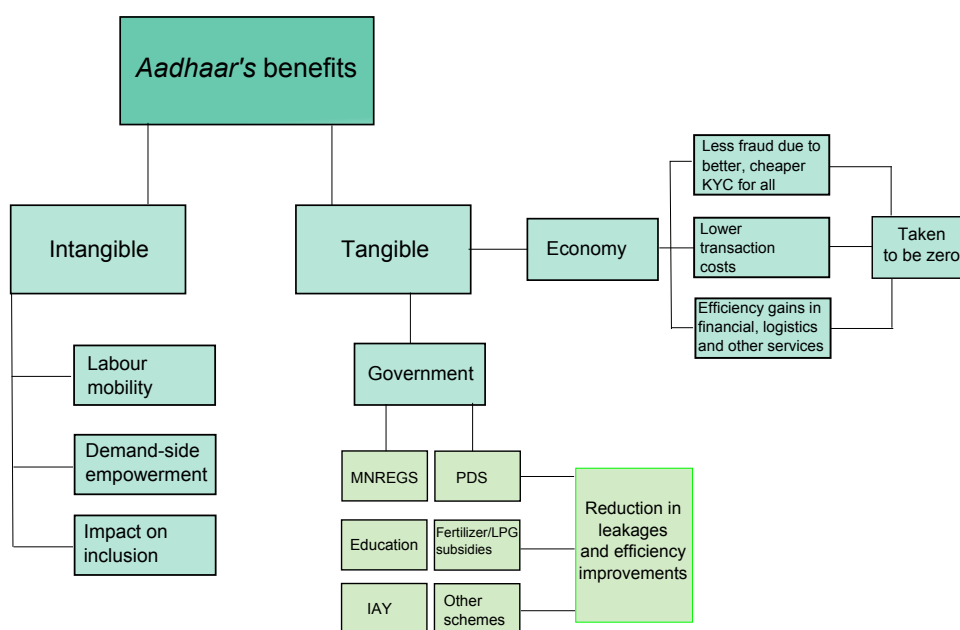
A full fledged cost benefit analysis of *Aadhaar* is hampered by two problems. First, many of the gains from *Aadhaar* are difficult to quantify as they are intangible (see Figure 1). A main benefit of *Aadhaar* is that it can make many of the existing

government programmes more demand-led, empowering the beneficiaries to hold the programmes accountable for their entitlement. For example, in PDS, once beneficiaries are enrolled with the system, it becomes easier for them to claim their benefits because they can authenticate their presence as beneficiaries. It also reduces leakages due to better matching of supply with demand. In another example, if the poor are able to access mobile-phone based payment systems, through which payments can be obtained or made at the cost and convenience of sending or receiving an SMS, this would be a revolution in financial inclusion.

Further, with non-digitised, local information on workers seeking jobs, an important aspect of the labour market, namely labour mobility is adversely affected. *Aadhaar* will make the migration experience in search of jobs easier by giving an identity to migrants in their destination locations. Similarly, rights and entitlements can be decoupled from the location of the resident. For instance, transaction costs involved in enrolling for a ration card in a new town/village/city in India are enormous. This entitlement is often forgone and it imposes high levels of opportunity cost for mobility. Such costs are expected to be driven down with a national identification mechanism and *Aadhaar* can play this role effectively. However, the gains from these are not easily quantifiable.

Second, in the case of specific schemes for which benefits are tangible, such as the MDM programme, while a reasonable case can be made that the use of *Aadhaar* in MDM will reduce leakages, the present state of knowledge does not permit precise quantification of the gains.

Hence, the approach taken in this paper is to use available information for government schemes such as PDS and MNREGS, where the literature has estimated some leakages. Then we use the learnings to make some assumptions for a few other schemes for which similar studies are scarce. Even for PDS and MNREGS, the studies are not always of the current year, and there have been technological and other changes that may have improved the efficiency of the schemes. For example, in MNREGS, the requirement that all wage payments should be made through a bank account reduces leakages that are inherent in cash disbursements. So, for PDS and MNREGS, the estimates are also adjusted to reflect the improvements that should have happened since the studies were conducted.

We consider the leakages due to identification and authentication errors that *Aadhaar* can address, i.e., the existence of duplicates and "ghost" beneficiaries. The benefits of reduction in leakages due to *Aadhaar* from these programmes are compared against the costs of building and integrating the various schemes with *Aadhaar*. Once the *Aadhaar* infrastructure is set up, since integration with the schemes may take some time, we assume that the benefits accrue with a lag.

Finally, we estimate the costs and benefits of *Aadhaar* to the government, in terms of expenses incurred by a government agency and the reduction in leakages respectively. Any reduction in leakages is considered a benefit, because the money can then be utilised for its real purpose i.e., for the targeted beneficiaries, or if the reduction in leakages leads to a reduction in the overall government expenditure required for the respective scheme, it is a benefit because the money can then be utilised in other programs. There are gains to the economy as a whole as well, which we set to zero in the current analysis.

Besides the ones considered, there are numerous other government schemes and programmes with the main mandate as some kind of transfer from the government to a citizen or resident. A report by the Consultative Group for Assisting the Poor (Breloff and Rotman, 2011) estimates that in 2008-2009, 22 welfare schemes paid out a total of about Rs. 3,25,000 crore. As more information becomes available on other schemes, the analysis can be expanded to include the true returns of the *Aadhaar* project.

2   Estimation of cost

There are two categories of costs involved in the *Aadhaar* project. First, the capital and operations expenditure for establishing and maintaining *Aadhaar* are taken into account. Second, the cost of integrating *Aadhaar* with various government schemes are factored into the estimation.

Capital and operating expenditure for developing and maintaining *Aadhaar* are obtained from the budget estimates of *Aadhaar*. The costs available in the budget are for a period of 7 years, i.e., from 2010-11 to 2016-17, with a projected enrolment trajectory achieving a coverage of 1.13 billion individuals by 2018. For the subsequent four years (from 2017-2018), we have adjusted the capital and operations expenditure of *Aadhaar* to reflect the steady state costs of maintaining *Aadhaar*. Note that since the enrolment responsibility is now equally divided between the Unique Identification Authority of India (UIDAI) and the Registrar General of India (RGI), the costs of *Aadhaar* enrolment may turn out to be lower.

Integration costs vary from one scheme to another. They take the form of capital and operations expenses incurred for developing and maintaining the infrastructure for authentication using *Aadhaar* and, in most cases, for integrating the respective scheme's database with *Aadhaar*, doing the required application development, and maintaining a database management system. For most programmes, it is assumed that integration requires similar capital infrastructure such as biometric

terminals and operations expenses on maintenance, connectivity and training. For programmes that involve payments through banks, the cost of providing incentives to the banking channels are taken into account. Thus for these schemes, it is assumed that the banking channel will be paid a percentage of the value transferred as an incentive.

Biometric terminals have been depreciated at 33 percent (straight-line) per year with the replacement cost reducing every three years. Application development and consulting costs are incurred in the first few years, and database management and support costs are assumed to be steady state costs. The spreadsheet provides details on these cost assumptions. The remaining costs have been assumed at 2011 prices, with no decrease over time. Appendix A provides detailed estimates of integration costs.

3   Estimation of benefits

Aadhaar is potentially useful for reducing leakages in a large number of government programmes. In this analysis, we estimate the gains for some government programmes that can benefit through integration with *Aadhaar*. We start by looking at PDS and MNREGS because of the existence of research literature and better data availability. We then extend the analysis to other schemes where we make assumptions on the leakages based on the aforementioned schemes. An estimation of leakages helps us understand the reduction of costs that will come about through the use of *Aadhaar*.

3.1   Public Distribution System (PDS)

The PDS system is envisaged to provide food to 65 million households (GOI, 2011e). Studies report large leakages and diversions of subsidised food grains. GOI (2005b) reports that 58 percent of the subsidised food grains issued does not reach targeted beneficiaries. Of course, some of the sources of leakage in PDS such as theft of grain in the supply chain cannot be solved using *Aadhaar* alone.

One of the reasons for this loss has been identification errors in the PDS delivery system. These identification errors may be due to many reasons. For example, beneficiaries may be non-existent ("ghost"), or may be duplicates, i.e., have obtained multiple identities for the purpose of obtaining subsidies. Admittedly, the problem of beneficiaries being incorrectly classified is a third identification error, but we assume that this problem cannot be solved using *Aadhaar* (Khera, 2011b).

Multiple sources point to different data on identification errors.[1] However, for the purpose of this discussion, we rely on the conclusions drawn by GOI (2005b), according to which diversion of subsidised grains to non-existent ("ghost") beneficiaries was reported at 16.67 percent.[2] We assume that utilising *Aadhaar* in PDS can help in combating this component only.

This estimate is somewhat fuzzy. A careful microeconomic analysis of PDS is urgently called for to arrive at better estimates of these critical system features. For instance, problems such as ghost beneficiaries may be only a partial source of leakage of PDS food grains (Khera, 2011b).

We adjust the estimate downwards by 25 percent to account for improvements in the system that may have taken place since the report was published. Thus the benefit through reduction in leakages assumed is 12.5 percent of the subsidy.

The total food subsidy for the year 2010-11 is Rs. 58,500 crore (GOI, 2012b). We adjust the value downwards by 30 percent to account for subsidies in the form of back-end costs, which are not consumer subsidies, for which exact data is not available.

The expenditure on kerosene subsidies in 2010-11 was around Rs. 19,600 crore (Nilekani, 2011). NCAER (2005) suggests that 38 percent of PDS kerosene does not reach its intended recipients (Rangarajan *et al.*, 2006; Business Standard, 2005). However, the report does not suggest what part of this leakage may be due to ghost or duplicate beneficiaries. Therefore, the proportion of leakage in PDS kerosene which may potentially be addressed by *Aadhaar* is assumed to be similar to the case of PDS food grains (GOI, 2005b). This estimated leakage is 11.1 percent of the subsidy. Again, the estimate is adjusted downwards by 25 percent to account for improvements in the scheme since the study was conducted. So, the benefit from integrating with *Aadhaar* is assumed to be 8.3 percent of the value of the expenditure on PDS.

Beyond these benefits, the integration of *Aadhaar* with PDS may also have benefits that are intangible at present and may not be immediately quantifiable. A case in point is that of the "portability" of benefits: *Aadhaar* being a universal (and portable) identification number may allow the government to offer portable subsidies irrespective of which state a beneficiary is in (UIDAI, 2010). However, this claim needs to be carefully studied before any attempts at quantifying this are made. For instance, operationalising a portable identity which links *Aadhaar* to the benefits of PDS will likely be a challenge in a scenario where the supply of subsidised commodities is linked to the previous months' demand (Khera, 2011b).

3.2 Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS)

The MNREGS programme is envisaged to provide 100 days of employment to all rural households. The cost of wages under the scheme constitutes about 70 percent of the total scheme expenditure. In 2011-12, the wage expenditure bill of the government was to the tune of Rs. 24,864 crore (GOI, 2011h). In order to ensure that this money reaches the intended beneficiaries, the MNREGS guidelines stipulate various transparency and accountability measures in the form of issuance of job cards, maintenance of muster rolls, monitoring and implementation systems and regular social audits. Despite these measures, studies indicate that implementation problems have been encountered in various states.[3]

A key problem with the implementation of MNREGS is diversion of funds, through ghost beneficiaries and inflated/ fake work records. Based on data collected from 8 states,[4] Chauhan *et al.* (2009) found a great deal of fraud such as making of fake job cards and improper maintenance of muster rolls.[5] The report however does not quantify the leakages caused on account of these problems. A series of state-level social audits have made attempts to record these anomalies.

An audit conducted by the Centre for Planning, Monitoring and Evaluation in 19 districts of Orissa during 2007-2008 (CPME, August 2008) found that muster rolls reflected 8.6 percent ghost beneficiaries, 23.1 percent ghost person days and only 61 percent of the claimed wage payments had actually been received by workers.[6] Arguably, Orissa reflects the extreme end of the spectrum and other states like Andhra Pradesh, Tamil Nadu, and Rajasthan have been much more effective in taking measures to check corruption under MNREGS (Dréze *et al.*, 2008). While state-wise variations in the implementation of the scheme are inevitable, problems similar to those found in Orissa have also been identified in other social audits albeit with varying intensity. Uttar Pradesh[7] (Dhuru, 2007), Jharkhand[8] (CDE, 2007b) and Chattisgarh[9] (CDE, 2007a) are some states for which similar audit reports are available.

Using the data from these various surveys, we estimate that a leakage of approximately 12 percent is being caused to the government on account of ghost workers and manipulated muster rolls.[10] We assume that 5 percent of the leakages can be plugged through wage disbursement using *Aadhaar*-enabled bank accounts and 7 percent through automation of muster rolls.

In addition to the benefits estimated above, integration of *Aadhaar* with MNREGS can lead to several other advantages that cannot be monetised. SPS (2009) notes that use of *Aadhaar* can be combined with wireless networks to register work

applications online. This will make actual work demand visible on the network for those monitoring the programme. The sanctioning of materials for carrying out work under MNREGS can also be linked to the *Aadhaar* system. Real time data on the number of labourers engaged in the project through *Aadhaar* authentication will allow supervisors to keep track of the materials required and therefore check pilferage. *Aadhaar*-based authentication can also be used in conjunction with the bank correspondent model to ensure more efficient access to their funds by MNREGS beneficiaries (SPS, 2009).

3.3 Education

SSA and MDM are the government's flagship programmes in the field of primary education. Under SSA, the government pays for schooling facilities, teacher's salaries, textbooks and uniforms for children. The MDM programme addresses their nutritional requirements through provision of cooked meals. The allocation of benefits under these schemes is on the basis of enrolment figures provided by each state.

The introduction of MDM and SSA is noted to have contributed greatly to improved enrolments in schools (GOI, 2010a). However, PROBE (1998) cautions that official enrolment data compiled from school records is often prone to exaggeration on account of under-age enrolments, nominal enrolment of children who do not actually attend school, double enrolment of children who attend private schools, and fake enrolment of ghost beneficiaries. Kumar and Rustagi (2010) observes that *"in many instances, enrolments figures are fudged for a variety of reasons including the pressure to report universal enrolment, the opportunity to get additional allocations of food and other materials that can be siphoned out, and sometimes even the need to retain a teacher's post."*

The government has to face losses in the form of wasteful expenditure and leakages arising due to inflated enrolment data. *Aadhaar* can help address this concern by providing a robust tracking mechanism to monitor the enrolment and attendance of students. On the one hand this will help address the problem of inflated enrolments of fictitious students and on the other, it will allow for real-time monitoring of the benefit distributions using attendance records. Any unused resources available with the school due to student absenteeism can be therefore be adjusted by the central government while making subsequent allocations to the state. In addition, the use of *Aadhaar* in the PDS distribution system will help plug leakage of food grains, which are to be disbursed to schools through the Food Stamp Programme (FSP). We assume that the integration of *Aadhaar* with the MDM scheme in the manner contemplated above will enable the government to save approximately 10 percent of the costs that it currently incurs on the scheme.

Leakages also exist in the distribution of books, scholarships, uniforms and bicycles to students under education schemes, which can be addressed by linking the distribution of these benefits with *Aadhaar* (GOI, 2012i). In the absence of data on the extent of leakages that exist on account of fake and duplicate beneficiaries, we have assumed this figure to be 10 percent of the total expenditure incurred by the government on books and uniforms for school children.

Use of *Aadhaar* can also help address a major problem that has been repeatedly noted with the SSA scheme - the problem of teacher absenteeism (Accountability Initiative, 2011; GOI, 2009b). States that have reported high rates of absenteeism include Madhya Pradesh where it was found that two-thirds of the teachers did not attend schools, Uttar Pradesh where the proportion of absent teachers was 20 percent, and Bihar, which reported figures of 25 percent (GOI, 2009b). A separate study found that 14 states were grappling with teacher attendance rates between 75 and 85 percent (GOI, 2009a). Keeping these studies in mind, we have assumed 10 percent absenteeism by teachers employed under SSA across the country. Thus the benefit of integrating with *Aadhaar* is taken to be 10 percent of the value of the transfers in this scheme.

To estimate the benefits of integration with *Aadhar*, the expenditure for teacher salaries, books and uniforms is taken as Rs. 16,491 crore in 2011-12 (GOI, 2011i);[11] and for MDM, it is taken as Rs. 9,128 crore in 2010-11 (GOI, 2012a). For the latter, we take 85 percent of the value to account for administrative expenses.

3.4 Fertiliser subsidy

The government prescribes the maximum price at which fertilisers may be sold. These prices are usually lower than the cost of fertilisers or the cost of importing them. The government subsidises the manufacturing and import of fertilisers to ensure that they are sold at the maximum price the government has set. Most of the subsidy amount is released to the manufacturer or importer when the fertilisers are received at district level, and the remaining is released when the fertilisers are sold to the dealer or retailer. The fertiliser moves from the producers/importers, to wholesalers/dealers, to retailers, and eventually to the farmers. In 2010-11, the entire subsidy bill for fertilisers amounted to about Rs. 62,301 crore (GOI, 2012c).

At present, there is no mechanism for identifying and authenticating the individual farmers who receive these fertilisers. This creates potential for diverting the fertilisers towards non-agricultural uses, which is a problem because the subsidies are justified by the agricultural use. The system also suffers from inefficiencies because of the low level of automation. For using *Aadhaar* to limit diversion and

other leakages, and for improving the efficiency in the system, the pre-conditions to be fulfilled are: policy decisions that mandate defining eligibility criterion for beneficiaries of the subsidies; and development of a database that helps identify the individual farmer purchasing the fertiliser.

The Task Force on Direct Transfer of Subsidies on Kerosene, LPG and Fertiliser has proposed a three phase process of moving towards direct transfer of subsidies into the bank accounts of the beneficiary farmers (Nilekani, 2011). Once this process has been implemented, it should be possible to directly transfer the subsidy amount into the bank account of the farmer, when the farmer buys the fertiliser. This should be possible with adequate technology infrastructure. With every retailer, there should be a device that authenticates the farmers. The information then flows directly into a database that is linked to another system that activates the decision to transfer money into the account of the farmer. Such a system should help ensure that diversion and leakages are reduced, and the efficiencies in the system improve with time. There are no comprehensive studies on the losses due to leakages and inefficiencies in this subsidy schemes. Using the estimates for PDS and MNREGS as benchmarks, we assume that using such an *Aadhaar*-enabled system would result in a benefit of 7 percent of the total value of subsidies.

3.5   LPG subsidy

The government subsidises the rate at which LPG cylinders are available for household consumption. The price of LPG cylinders meant for commercial use is not subsidised. There are reports of widespread diversion of LPG cylinders towards commercial use, and other forms of leakages in the system. For example, it is possible that some households may be using the subsidised LPG cylinders for non-household purposes. The total subsidy bill for the government in the year 2009-10 was Rs. 16,071 crore (Nilekani, 2011).

Though at present there are no limits on the number of LPG cylinders a household may use, it may be a good idea for the government to limit the level of subsidy by putting a cap on the number of cylinders, as has been recommended by the Task Force on Direct Transfer of Subsidies on Kerosene, LPG and Fertiliser (Nilekani, 2011). Subsequent to such a policy decision, it will become important to identify and authenticate individuals who are using LPG cylinders. For this *Aadhaar* can play a crucial role. *Aadhaar* database can be linked with the database of households using LPG cylinders, and the individuals purchasing the cylinders can be authenticated. This would help minimise the leakage and diversion of cylinders meant for household consumption.

Even if the government does not take the policy decision of putting a cap on household consumption of LPG cylinders, biometric authentication of individuals purchasing cylinders would help keep track of where the cylinders are being used. This itself can help minimise the diversion of cylinders. Of course, if the government does not cap the number of cylinders to be used by households, it would be possible for households to purchase the cylinders and sell them in the market, as one would expect in a market with two prices for the same product (a subsidised price and a non-subsidised price). Even after accounting for such diversion, the leakage and diversion done by the distributors and retailers should reduce just by identification and authentication using *Aadhaar*.

Though there are reports of raids finding extensive use of subsidised LPG cylinders for commercial purposes (TERI and IISD, 2012), there are no comprehensive studies documenting the extent of leakage and diversion. In the absence of such robust studies estimating the leakage from the system towards commercial use, we assume that use of *Aadhaar* would result in a benefit of 10 percent of the value of the subsidy (similar to PDS).

3.6   Indira Awaas Yojana (IAY)

Under this scheme, the government provides grants to identified households below the poverty line in rural areas for the construction and upgradation of houses. The targeted beneficiaries include those belonging to the scheduled castes and tribes, minorities, freed bonded labourers, disabled persons, former members of the paramilitary forces and family of military personnel killed in action. The construction assistance provided is Rs. 45,000 per unit in plain areas and Rs. 48,500 in hilly areas (GOI, 2011a). The number of houses under construction sanctioned during the year 2010-11 was 19,52,914 (GOI, 2010b). Hence we calculate that the value of financial assistance given was Rs. 8,788 crore. The disbursement of funds takes place through bank and post office accounts (GOI, 2012j).

Some reports highlight that there is corruption in this scheme, leading to leakages of IAY funds. Funds are allotted to multiple members of the same family, the benefit is given twice to one beneficiary, houses are allotted to government officials, bribes have to be paid, and middlemen create inefficiencies (GOI, 2010c; IFMR, 2009; Ahmad, 2009). Though exact numbers for leakages are not known, since the disbursement takes place through bank accounts, there can be leakages due to fake beneficiaries as well as the existence of "ghosts", which *Aadhaar* can plug. We assume that leakages are of the order of 10 percent which can be reduced by using *Aadhaar*-enabled accounts.

3.7 Other schemes

We include other government schemes in the analysis where integration with *Aadhaar* can reduce leakages that arise due to identification errors. Since the transfer of benefits takes place through bank or post office accounts in these cash transfer programmes, we assume that having *Aadhaar*-enabled bank accounts will result in a benefit of 7 percent of the value of the transfer. The schemes considered are:

3.7.1 Scholarships

A number of scholarship schemes have been put in place by the government to support meritorious students belonging to disadvantaged backgrounds. In several cases the scholarships are disbursed directly to the bank or post office account of the student so as to ensure that payments are made in a timely and correct manner (GOI, 2010d). Disbursing payments through *Aadhaar*-enabled bank accounts will make the process more efficient and prevent funds from being diverted to bogus bank accounts. We use the aggregate government expenditure of Rs. 4,519 crores on various scholarship schemes to compute the cost savings through integration with *Aadhaar*.[12]

3.7.2 Pensions

Studies find that overall leakages in social pension schemes, particularly old age pensions, are relatively lower than other government programmes. However, leakages do take place in some areas due to duplication and fake entries, and because those who have died are not removed from the records and their benefits continue to be claimed (Dutta *et al.*, 2010; Dutta, 2008).

Pensions are paid through bank accounts in most cases. Here, duplicates and "ghosts" can exist. Where disbursement is through money order or cash (Dutta, 2008), *Aadhaar* can play a role in reducing leakages in payments. It will also help in keeping accurate records which reduces the possibility of diversion of funds to non-beneficiaries.

We use the budget allocation for the National Social Assistance Programme (NSAP) of Rs. 5,110 crore for the analysis (GOI, 2012d).[13]

3.7.3 Janani Suraksha Yojana (JSY)

This is a safe motherhood intervention under the National Rural Health Mission (NRHM) intended to promote institutional delivery among the poor pregnant women. It is entirely sponsored by the central government and has special dispensation for states that have low institutional delivery rates,[14] classified as Low Performing States (LPS) (as against High Performing States (HPS)). The scheme provides cash assistance to all eligible mothers for delivery. The link between the health facility and the community is the Accredited Social Health Activist (ASHA) (GOI, 2011b).

The coverage of JSY in 2010-11 stands at 113.38 lakh women, spread across LPS and HPS.[15] The expenditure under the scheme for the same period was Rs. 1,600 crore (GOI, 2011b). It is assumed that this expenditure is the entire payout amount under this cash transfer scheme, although it is possible that there are administrative and management costs involved (UNFPA, 2009). However, since JSY is part of the larger NRHM project, it is assumed that the scheme's administrative costs are relatively negligible, and the major costs are in fact subsumed by the latter.

3.7.4 Accredited Social Health Activists (ASHA)

According to GOI (2011g), there are an estimated 7,30,909 ASHAs in India.[16] The ASHA is a health activist who acts as the link between the community to the health care system. The initiative is designed to create awareness on health issues, motivate the community, and help improve access to basic health services. Appointed under NRHM, ASHA workers are usually female, and are accountable to the village panchayat. ASHAs receive performance-based compensation for carrying out various activities, including promoting universal immunisation, referral and escort services for reproductive and child health, and other programmes. There are general guidelines for the appointment of ASHAs, but states have the discretion to customise to their own requirements (GOI, 2005a).

The maximum compensation an ASHA can receive is approximately Rs. 17,200 in a year, assuming that the entire range of services are provided. However, studies suggest that this number varies across states (Bajpai and Dholakia, 2011), and the average amount of incentive per ASHA is lower annually. At an average of Rs. 12,000 per annum, we compute the total expenditure on payments to ASHAs as Rs. 877 crore.

3.7.5 Integrated Child Development Centres (ICDS)

Anganwadi centres have been created under the ICDS and are part of the public health care and education system. These centres cater to the development needs of children in the age group of 3-6 years, including through pre-school education, as well as provide health and nutrition counselling and care to infants and children up to the age of 3 years, and pregnant and lactating mothers (GOI, 2005a). Anganwadi centres are staffed with anganwadi workers (AWW) and anganwadi helpers (AWH). As of 31 March 2011, according to GOI (2011j), 11,74,388 AWWs, and 11,04,098 AWHs were in position.[17]

AWWs and AWHs are paid an honorarium which is decided by the government. According to GOI (2011f), the Cabinet Committee on Economic Affairs has revised the honoraria amounts to Rs. 3,000 per month (for AWWs) and Rs. 1,500 per month (for AWHs).

4   Internal rate of return

The calculations in this document are summarised in Table 1. The internal rate of return in real terms generated by *Aadhaar* is 52.85 percent.

The analysis shows that the IRR will depend on how comprehensive and rapid the integration of these programmes with *Aadhaar* is going to be.

Table 1 Cost-benefit analysis of *Aadhaar*

(Rs. crore at constant prices)

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Total cost	270	12,00	2,265	2,674	3,696	3,853	4,423	4,272	4,871	4,828	4,835
Total benefit	0	0	425	1,082	2,206	4,502	9,192	18,778	23,989	24,532	25,100
Net benefit	−270	−1,200	−1,840	−1,592	−1,489	649	4,769	14,506	19,118	19,704	20,265
(Real) IRR (percent)	**52.85**										

5   Summary

It is important to judge these estimates in close connection with the assumptions that went into the estimation. For the detailed assumptions, refer to Appendix A. We have made the following key assumptions:

1. The integration of *Aadhaar* into government programmes takes place from 2 percent coverage of participants in 2012-13 to 100 percent coverage in 2018-2019. (The sequence is shown in the row 'Roll-out' in Table 5.)

2. The expenses incurred for developing and maintaining *Aadhaar* during the first seven years are those envisaged in the *Aadhaar* budget estimates. For the subsequent four years, we assume certain steady state costs of maintaining *Aadhaar*.

3. For this analysis, it is assumed that certain government programmes obtain improvements through *Aadhaar* integration. The schemes are: MNREGS, PDS, fertiliser and LPG subsidies, education, IAY, ASHA, ICDS, scholarships and pensions.

4. Leakage estimates for MNREGS and PDS are obtained from government reports and other studies. The estimated leakage is adjusted downwards by 25 percent to account for dated studies and technology improvements due to which leakages maybe lower now.

5. For other schemes, we assume leakages between 7-10 percent.

In conclusion, based on our assumptions, *Aadhaar* project has an internal rate of return in real terms of 52.85 percent to the government.

Appendices

A   Assumptions

Table 2 lists all the common assumptions and Tables 3 and 4 list scheme specific assumptions that go into the estimation of benefits and costs in this paper. We assume that:

1. The cost of biometric device (POS device) is assumed at the rate of bulk purchase, and it is assumed that the cost of replacement every 3 years will fall.[18]

2. Training, device maintenance and support, and connectivity costs are assumed at the 2011-12 levels. There is an annual training cost of Rs. 500 per person trained. Each device will require Rs. 500 for maintenance support per annum. Connectivity costs are assumed at Rs. 1,200 per annum per device.

3. Wherever there is payment to be made through *Aadhaar*-enabled bank accounts, incentives to be paid to banks will be as follows: banks will be paid 3 percent of the value during the first 5 years, and 2.5 percent subsequently.

4. The real wage transferred in MNREGS will not go up over time.

5. The price of commodities transferred through the PDS will not go up over time.

6. Annual increase factor differs by scheme: For food grains, it is assumed to be 5 percent, given the upcoming changes in the food security schemes. For fertiliser subsidy, it is assumed that there will be a 2 percent annual decrease in subsidies, because the government has indicated it will rationalise and reduce these subsidies. For LPG subsidy, it is assumed that there will be no increase in the subsidy even due to population increase, because it seems likely that the government will either stagnate or reduce the subsidies, which is likely if reforms are brought to the subsidy regime. For all other schemes, an annual increase factor of 2 percent on account of population increase is assumed.

B Benefits and costs: details

See Tables 5 and 6 for detailed break-up of benefits and costs of integration with *Aadhaar.*

Table 2 Common assumptions underlying benefits and costs analysis

Variable	Units	Value
Project life cycle	years	11
POS device cost	Rs. per year	$12,000^a$
Depreciation rate	percent per year	33
POS maintenance cost	Rs. per device per year	500
Connectivity cost per device	Rs. per year	1,200
Training and support cost	Rs. per staff per year	500
Payment to bank	percent of transfer	3^b
Population increase	percent	2

a. It is assumed that the cost will fall every three years, so replacement cost is lower than purchase cost

b. From the sixth year onwards, it falls to 2.5 percent of the value paid

Table 3 Scheme specific assumptions

Variable	Units	Value
MNREGS		
Wages disbursed	Rs. crore	24,864
Total units (1 unit per panchayat) (2009-10)	nos.	2,39,627
Leakage related to muster rolls	percent of wages	7
Leakage related to bank account disbursements	percent of wages	5
PDS		
PDS consumer subsidy on food grains (2010-11)	Rs. crore	45,000
Targeting / ID error for food grains	percent	16.7
Adjusted leakage for food grains	percent	12.5
Kerosene subsidy (2010-11)	Rs. crore	19,600
Kerosene leakage	percent	38
Targeting / ID error for kerosene	percent	11.1
Adjusted leakage for kerosene	percent of subsidy	8.3
Fair Price Shops (FPS)	nos.	4,77,000
POS devices per FPS	nos.	1
Fertiliser		
Subsidy (2010-11)	Rs. crore	62,301
Decrease in subsidies per year	percent	2
Shops	nos.	2,30,000
Leakage	percent of subsidy	7
LPG		
Subsidy (2009-10)	Rs. crore	16,071
Distributors	nos.	10,000
Units per distributor	nos.	5
Staff to be trained per distributor	nos.	5
Increase factor	percent	0
Leakage	percent of subsidy	10
Education		
Teacher salaries	Rs. crore	14,467
Expenses on books	Rs. crore	1,026
Expenses on uniforms	Rs. crore	998
Mid day meals (2010-11)	Rs. crore	7,759
Schools	nos.	12,37,000
POS devices per school	nos.	2
Staff per school (for training costs)	nos.	3
Leakage	percent of expenditure	10
IAY		
Houses sanctioned	nos.	19,52,914
Amount per unit	Rs.	45,000
Total expenditure (2010-11)	Rs. crore	8,788
Leakage	percent of expenditure	10

Table 4 Assumptions: Other schemes

Variable	Units	Value
Leakage	percent of transfer	7
JSY		
Allocation	Rs. crore	1,600
ASHA		
Number of ASHAs	nos.	7,30,909
Average payment per ASHA	Rs. per annum	12,000
Total payments to ASHAs	Rs. crore	877
ICDS		
Number of Anganwadi workers	nos.	11,74,388
Average payment per Anganwadi worker	Rs. per annum	3,000
Number of Anganwadi helpers	nos.	11,04,098
Average payment per Anganwadi helper	Rs. per annum	1,500
Total payments to Anganwadi workers and helpers	Rs. crore	518
Scholarships		
Allocation	Rs. crore	4,519
Pensions		
Allocation	Rs. crore	5,110

Table 5 Benefits of *Aadhaar*

(Rs. crore at constant prices)

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Roll-out (percent)	0	2	5	10	20	40	80	100	-	-
MNREGS	0	61	155	317	646	1,318	2,688	3,427	3,496	3,566
PDS	0	158	412	861	1,797	3,752	7,834	10,226	10,680	11,155
Fertiliser subsidy	0	87	214	419	821	1,609	3,154	3,863	3,786	3,710
LPG subsidy	0	32	80	161	321	643	1,286	1,607	1,607	1,607
Education	0	50	127	259	528	1,078	2,199	2,803	2,859	2,917
IAY	0	18	47	95	194	396	808	1,030	1,050	1,071
Other schemes	0	18	47	95	195	397	810	1,032	1,053	1,074
Total Benefits	0	425	1,082	2,206	4,502	9,192	18,778	23,989	24,532	25,100

Table 6 Costs of *Aadhaar*

(Rs. crore at constant prices)

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Roll-out (percent)	0	0	2	5	10	20	40	80	100	100	100
Aadhaar costs[a]											
Total exp.	270	1200	2182	2060	2379	2193	2102	1000	1000	1000	1000
Integration costs											
MNREGS	0	0	28	136	232	308	502	753	931	945	959
PDS	0	0	6	85	186	213	246	326	372	352	352
Fertiliser subsidy	0	0	3	77	153	165	191	210	232	212	212
LPG subsidy	0	0	1	62	123	126	131	119	124	104	104
Education	0	0	32	130	333	486	772	1,213	1,446	1,436	1,416
IAY	0	0	5	34	89	118	159	242	297	303	308
Other schemes	0	0	8	90	201	243	320	409	469	476	484
Total costs	270	1,200	2,265	2,674	3,696	3,853	4,423	4,272	4,871	4,828	4,835

a. Till 2011-12, the actual costs are presented. For subsequent years, the estimated costs are considered.

Notes

[1]For example, Kapur and Chowdhury (2011) suggest that between 2006 and 2010, 37 lakh ration cards issued to households in the states of Bihar, Madhya Pradesh, Uttar Pradesh and Orissa were fake or had been issued to "ineligible" households. Similarly, PTI (2011) suggests that Karnataka has at least 30 lakh fake ration cards. Elsewhere, Radhakrishnan (2010) says that eight lakh bogus ration cards were detected and cancelled in 12 districts in Tamil Nadu.

[2]A more recent study (Khera, 2011a) calculates that in the year 2007-08, the proportion of food grains that did not reach households may have been lower than what is suggested in GOI (2005b), at 44 percent. However, Khera (2011a) does not suggest what proportion of this leakage is due to identification errors.

[3]See CPME (August 2008); Dréze *et al.* (2007); Dhuru (2007); CDE (2007b,a)

[4]Andhra Pradesh, Bihar, Gujarat, Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

[5]For instance, Chauhan *et al.* (2009) found cases where workers performed one day's job, but their attendance was marked for 33 days. 32 days of wages were being misappropriated by people associated with the delivery of the scheme.

[6]Also see Dréze *et al.* (2007) where it was found in a survey of three districts of Orissa that only 60 percent of the days of employment recorded in the muster rolls could be confirmed by the concerned labourers, thus implying massive discrepancies in wage payments.

[7]In a survey conducted in 5 districts, it was found that in 86 percent of cases muster rolls were fabricated using forged signatures/ thumb impressions. Discrepancies were also noted between muster roll records and actual payments in five Gram Panchayats from four districts. The amount actually paid was just 18 percent of the amount paid according to muster rolls.

[8]In a survey conducted in Ranchi district in Jharkhand, only 67 percent of the wage payments entered in the muster rolls were found to be genuine.

[9]In 9 randomly selected sites in Surguja district in Chattisgarh, it was noted that 95 percent of the money paid to labourers according to the muster rolls actually reached them. However, the surveyors noted that they were able to verify the muster roll details for only 109 of the 270 randomly selected labourers as other labourers were not available or could not recall the payment details. It is however not clear whether this non-availability could be on account of ghost workers.

[10]The leakage estimate available in any one source is not representative of all states. The numbers range from 5 percent in Chattisgarh to almost 80 percent in Uttar Pradesh. We have assumed that the 31 states are broken into three equal categories: Worst performing (with leakage of 35 percent), reasonably performing (with leakage of 15 percent) and best performing (with leakage of 5 percent). The weighted average of the leakage is about 18 percent. For our analysis, we reduce the estimate to 12 percent.

[11]The expenditure amounts as available at GOI (2011i) were updated only till 31 December 2011. The teacher salaries have been pro-rated to estimate the expenditure for the entire financial year from April 2011 till March 2012.

[12]The aggregate figure of Rs. 4,519 crores for scholarships is based on the Expenditure Budget (2012-13) for scholarships provided by the Ministry of Social Justice and Empowerment (GOI, 2012e), Ministry of Tribal Affairs (GOI, 2012f), Ministry of Minority Affairs (GOI, 2012g) and Ministry of Human Resource Development (GOI, 2012h).

[13]This includes the amount for Annapurna, where disbursement is not through a bank account, but since a breakup of the allocation is not available, we use the full amount

[14]These states are Uttar Pradesh, Uttrakhand, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Assam, Rajasthan, Orissa and Jammu & Kashmir.

[15]See GOI (2011d) for population distribution across LPS and HPS.

[16]GOI (2011c) points out that over 8.5 lakh ASHA workers have been trained since 2005-06. However, the GOI (2011g) numbers are assumed for this calculation.

[17]In the latest budget (GOI, 2012k), the central government has approved a cumulative number of 14 lakh Anganwadi Centres/Mini Anganwadi Centres.

[18]For a detailed exposition of this price theory, see Nambiar and Poess (2011).

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