

Achieving Equitable Growth – An Assessment of the Impact of Digital Public Infrastructure on Informal Workers in India

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ABSTRACT

In this paper, I examine the extent to which Digital Public Infrastructure (DPI)-digital systems that provide identity, enable payments, facilitate the delivery of population-scale services by public and private actors- has improved the living standards of informal workers in India by explaining the historical challenges such workers faced like a lack of identification, wage exploitation, and inequitable access to social benefits. Through initiatives like Aadhaar, DPI has reduced income and access leakages, improved the targeting and delivery of subsidies, and expanded access to essential services- partially overcoming the Efficiency-Equity trade-offs inherent in the Second Theorem of Welfare Economics. I also highlight DPI's concerns around data privacy and information misuse for political or personal gain. While DPI has proven effective in reducing corruption and improving benefits distribution, further measures are necessary to address structural inequalities and protect informal workers from continued exploitation. Future policy directions should be focused on enhancing income opportunities and addressing information asymmetries to ensure sustainable improvements in living standards.

Introduction

India has performed very well in the last decade, nearly doubling its GDP and growing more than 6% annually.¹ There are, however, significant and persistent inequalities in income distribution in large part because 90% of the labour force comprise "informal workers".² Historically, such workers struggled to earn consistent wages and were unprotected by labour legislation and other social safety nets. They faced exploitation by intermediaries, a lack of market access and leakages in direct benefits for food and cooking gas. This essay examines how the development of Digital Public Infrastructure (DPI)- digital systems that provide identity, enable payments, facilitate the delivery of population-scale services by public and private actors- has improved living standards for these workers. I do this by outlining the challenges informal workers faced, showing how DPI has improved these challenges by referring to the fundamental theorems of Welfare Economics and benefits-targeting models, identifying the concerns and limitations around DPI provision, and laying out how DPI can improve opportunities for informal workers.

In short, this essay argues that DPI is overcoming the equity-efficiency trade-offs set forth in welfare economics. Direct benefits schemes have already helped informal workers by creating stronger safety nets. However, more measures are needed to reduce exploitation by undue government and employer controls and information barriers and to catalyse job creation in the future.

Informal Workers in India

There are more than 439 million informal workers in India.³ As shown in Figure 1, their presence is vast across many sectors. For many years, such workers struggled with deeply structural issues: for example, in 2009, 70% of the population was excluded from central and state government welfare schemes due to poor quality databases, and only 24% of people were covered by one social protection scheme.⁴ Even in small enterprises, a Ministry of Planning and Statistics survey showed that there has been persistent 3-4x annual wage disparity between formal and informal workers (see Figure 2).⁵

Groups of workers, by sex, in India, urban India, and Delhi, 2017-18: Millions and per cent of total employment in parenthesis						
Worker Group	India			India Urban		
	Total	Women	Men	Total	Women	Men
Home-based worker	41.855 (9.1)	17.195 (16.4)	24.660 (6.9)	16.998 (11.8)	6.776 (22.7)	10.222 (8.5)
Domestic worker	5.235 (1.1)	3.399 (3.2)	1.836 (0.5)	3.811 (2.5)	2.825 (9.4)	0.986 (0.8)
Street vendor/market trader	11.887 (2.6)	1.201 (1.1)	10.685 (3.0)	6.288 (4.2)	0.687 (2.3)	5.601 (4.7)
Waste picker	2.197 (0.5)	0.721 (0.7)	1.475 (0.4)	1.516 (1.0)	0.527 (1.8)	0.989 (0.8)
Informal construction*	51.937 (11.2)	5.155 (4.9)	46.781 (13.1)	14.174 (9.4)	1.188 (4.0)	12.986 (10.8)
Informal transport*	20.164 (4.4)	0.097 (0.1)	20.067 (5.6)	9.543 (6.4)	0.062 (0.2)	9.482 (7.9)
All groups	133.275 (28.9)	27.770 (26.5)	105.505 (29.6)	52.330 (34.8)	12.064 (40.3)	40.266 (33.5)

Figure 1. Source: Women in Informal Employment: Globalizing and Organizing (WIEGO)

Key indicators of ASUSE 2021-22(annual) and ASUSE 2022-23 (annual) (all-India)						
Parameter	ASUSE 2021-22(annual) (April,2021 – March,2022)			ASUSE 2022-23(annual) (October,2022 – September,2023)		
	R	U	R+U	R	U	R+U
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Percentage of Market Establishments	99.63	99.55	99.60	99.52	99.60	99.56
Percentage of Proprietary and Partnership Establishments	94.61	98.36	96.28	93.26	98.04	95.42
Percentage of Hired Worker Establishments	7.00	23.10	14.15	8.01	23.33	14.94
Emoluments (Rs.) per Formal Hired Worker	2,87,423	2,30,025	2,47,644	2,34,698	2,48,708	2,44,734
Emoluments (Rs.) per Informal Hired Worker	90,651	1,13,000	1,06,381	91,151	1,20,527	1,10,982
Emoluments (Rs.) per Hired Worker [@]	1,17,153	1,30,092	1,26,243	1,03,689	1,34,882	1,24,842
Gross Value of Output (GVO)* (Rs.) per Establishment	2,52,883	5,80,311	3,98,304	2,99,890	6,61,407	4,63,389
GVA (Rs.) per Establishment*(Rs.)	1,44,570	3,26,480	2,25,362	1,53,016	3,41,298	2,38,168
GVA per worker* (Rs.)	1,01,202	1,73,335	1,38,207	1,04,483	1,75,842	1,41,769

Figure 2. Source: Ministry of Statistics and Programme Implementation (MOPSI)

Until 2014, many informal workers lacked identification and bank accounts and were therefore subject to exploitation by middlemen. In the construction sector, for example, local contractors responsible for distributing **income** would often inflate the number of workers on the payroll and/or underreport the number of days employees worked. Therefore, workers were not compensated fairly. Because these workers did not have bank accounts, they had no means to directly receive their wages or even challenge these discrepancies.

Informal workers were also subject to exploitation in access to public distribution **benefits**. The main culprits were officials responsible for distributing benefits like food (e.g., rice) and healthcare (e.g., vaccinations). Their role was to oversee the transportation of food grains from government warehouses to Fair Price Shops (FPS) where beneficiaries access their rations. The lack of checks and balances enabled many officials to divert large proportions of food grains meant for the needy. In fact, a report by the Planning Commission revealed that upwards of 36% of food grains in states like Bihar, Jharkhand, and Chhattisgarh were pilfered by intermediaries and resold at premiums on the black market.⁶ Without authentic identification and bank accounts to receive money to purchase food grades, it was easy for intermediaries to exploit informal workers.

This exploitation carried through to social security and pension benefits too. Since many informal workers lacked formal identification and/or permanent addresses, it was challenging for them to navigate the system and obtain ration cards necessary to claim benefits. Middlemen would offer to “assist” workers in registering social security and pension schemes. In many cases, these intermediaries would mislead workers about their eligibility or charge them for fake registration processes. In more extreme circumstances, they would intercept and take a proportion of pension payments intended for the workers. The lack of identification resulted in many of these informal workers either being excluded from these benefits and/or had to pay bribes to access them.

In this context, this essay will take a Welfare Economics lens to understand the extent to which DPI is helping solve these issues for informal workers.

Welfare Economics and the Role of DPI

One method for assessing the impact of DPI is to examine the extent to which it can help address the Equity-Efficiency trade-off outlined in the Second Theorem of Welfare Economics. The trade-off arises in balancing the need to maximise the productive output of the economy (i.e., efficiency) while also preventing an over-concentration of income

amongst a few people at the expense of the rest of the population. The First Theorem of Welfare Economics postulated that competitive free markets produce Pareto-efficient results. The Second Theorem shows that it is possible to also achieve Pareto-efficiencies through the redistribution of wealth.⁷ Paul Samuelson's seminal 1947 paper demonstrates that a new market equilibrium can be reached that appropriately redistributes income through lump sum taxes and subsidies.⁸ Stiglitz and Greenwald in their 1986 paper- and later in Stiglitz's 2017 lecture- argue that these theorems do not hold true in the real world with imperfect markets. They instead proffer that achieving both equity and efficiency requires more than simple redistribution—it demands active economic policies tailored to real-world complexities.⁹ More fundamentally, the philosopher John Rawls showed that the path to a more equitable society would arise from improving the living standards of the least well-off people (in the Indian context, informal workers).

Despite noble intentions, governments have fallen short on designing and implementing effective economic redistribution policies due to information failures, leakages, and corruption. This has been a global issue. In fact, A UNDP study across 70+ low- and middle-income countries show that between 3-5% of annual social transfers were lost due to corrupt activities.¹⁰ In Welfare Economic terms, it has been difficult to overcome the Efficiency-Equity trade-off. DPI has the potential to break through these challenges.

The Indian government has employed DPI to address many of the challenges informal workers face. At the very heart of these infrastructures is digitally automated identification linked to bank accounts that can be accessed via mobile phones and the internet. This has laid the foundation for the “India Stack”, which refers to open programming interfaces that enabled the have made DPI so accessible across the country. Applications of these interfaces can be seen in Figure 3.¹¹

The Aadhaar card, the government's flagship programme, has granted identification to over 1.3 billion people- 390 million of whom are informal workers- and has enabled 49% of Indians to access one or more government service for the first time. It uses a unique 12-digit biometric authenticator to facilitate access to essential services like banking, healthcare, and education.¹²

Emergence of digital public infrastructure to unlock digital inclusion at population scale.

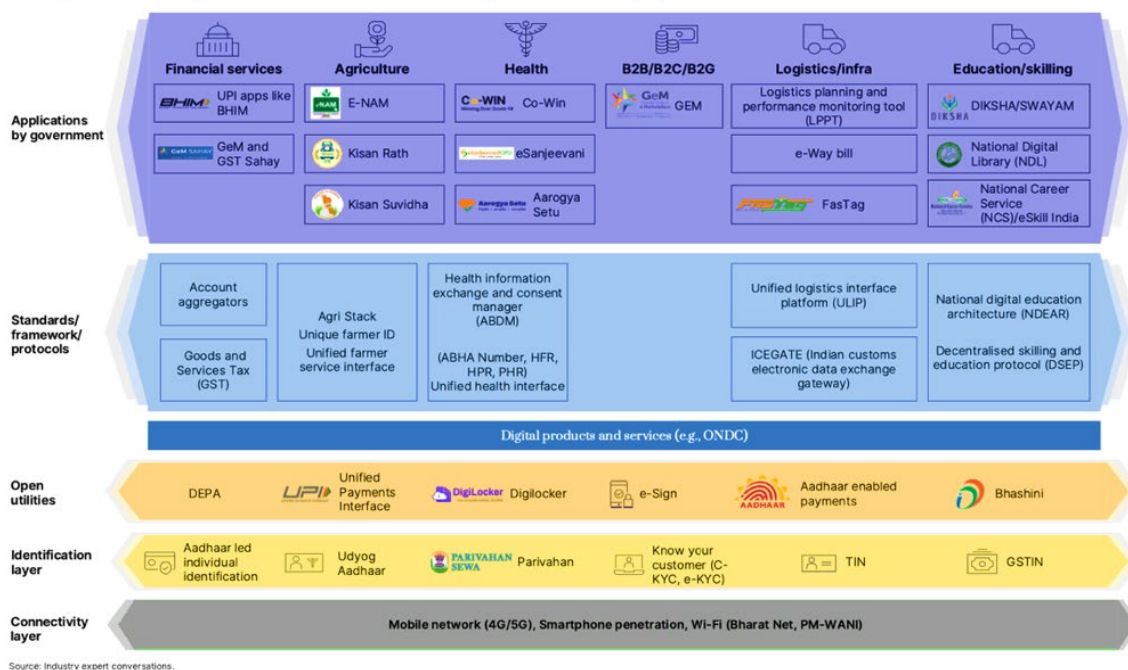


Figure 3. Source: ONDC

By linking Aadhaar to bank accounts through the direct payments system, **income** exploitation reduced because local contractors who previously manipulated payrolls and underreported workdays are no longer needed. A 2017 study by the Indian Council for Research on International Economic Relations (ICRIER) reported that the adoption of Aadhaar in wage distribution reduced payment delays by over 50% and a 25% decrease in cases of workers receiving less than their due wages.¹³ In addition, the World Bank noted that Aadhaar's integration with bank accounts contributed to a 14% increase in account ownership among informal workers between 2014 and 2017.¹⁴ This expansion of formal access has increased workers total propensity to consume and invest, a key indicator of living standards.

Aadhaar perhaps had its most significant impact in the provision of and efficient delivery of **benefits** and overcome the challenges set out on Page 2. At a base level, ration cards used to claim benefits are linked to a 12-digit biometric authenticator. Fair Price-Shops now solely accept these linked ration cards- which account for household income, location, and health needs- which have reduced leakages by up to 34%.¹⁵ At a deeper level, Aadhaar has acted as a building block for many public service legislations like the National Security Food Act (NFSA). The act aims to provide subsidised food grain to two thirds of India's population to enhance food and nutritional security. Eligible households are entitled to receive 5 kg of food grains per person per month at highly subsidised rates. Aadhaar has significantly decreased instances of fraud, with a reported 20-25% increase in food grain availability for beneficiaries and a 7% reduction in malnutrition among vulnerable populations.¹⁶

Aadhaar linked bank accounts have moved from 67mn in 2014 to 770mn in 2023. There has been an eight-fold increase in the benefits transferred to these Aadhaar-linked accounts between 2017-2023.¹⁷ With this vast provision of benefits, individuals, many of whom are informal workers, have more discretionary income and therefore have a greater willingness and ability to spend on goods and services in the economy, indicating an all-round improvement in living standards.

Using the example of Liquefied Petroleum Gas (LPG) subsidies, a cleaner alternative to wood burning and kerosene previously used by many informal workers to cook their food, I **model** the significance of Aadhar and its ancillary systems in ensuring efficient and well-targeted benefits transferring.

For many years, the LPG subsidy scheme was plagued by inefficiencies and widespread corruption. One significant issue was the prevalence of ghost beneficiaries- fake identities or duplicate connections used to fraudulently claim subsidies. In fact, the 2011 consensus reported that the number of LPG connections was about 50% higher than the number of actual households. Siphoning of resources by ghost beneficiaries meant that intended financial support was often diverted into black markets, where LPG was sold at higher rates for commercial use.¹⁸ Figure 3 shows the quantities supplied and demanded per unit for both households and households and beneficiaries.

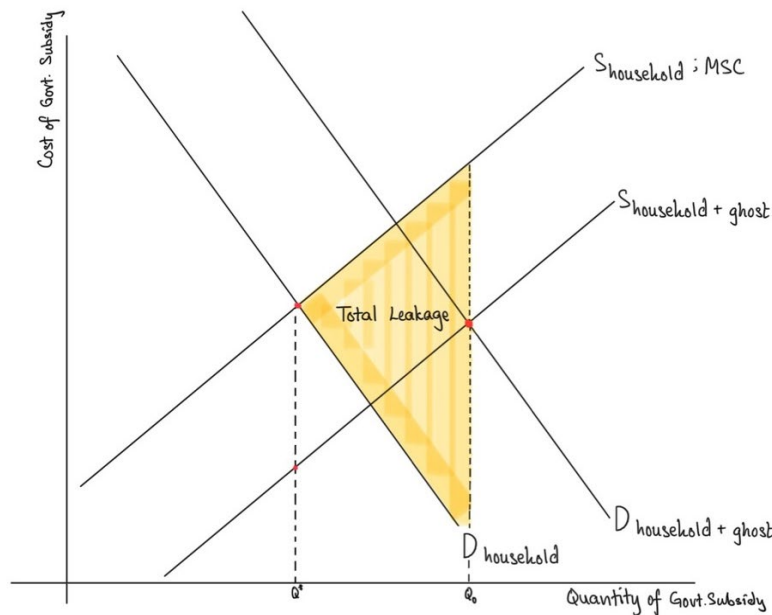


Figure 5. Direct Benefits Transfer Leakage Graph

Before DPI, the market equilibrium for benefits was where $S_{\text{household} + \text{ghost}} = D_{\text{household} + \text{ghost}}$. The allocatively efficient equilibrium is where Marginal Social Benefit = Marginal Social Cost. The presence of ghost beneficiaries artificially inflated the demand for and supply of LPG subsidies, leading to a greater quantity demanded and supplied per unit than if the subsidies had been distributed solely to actual household. At the market equilibrium, therefore, the marginal social costs of providing each additional unit of subsidy are greater than the marginal social benefits, creating a leakage highlighted by the triangle in Figure 5.

The impact of these leakages is profound. Fundamentally, informal workers do not receive the full suite of potential benefits when ghost entities siphon off a proportion of their subsidy. Furthermore, as ghost beneficiaries sell LPGs on the black market, they make profit. Since LPGs are a necessity, informal workers have relatively inelastic demand for it and therefore are willing to spend large proportions of their meagre and often variable income to gain access to them in the black market. On a macro scale, these leakages have reduced the multiplier impact of these subsidies.

DPI has allowed for a more efficient and well-targeted distribution of LPG subsidies. Because Aadhaar and related systems require individuals to fill details like their age, address, financial information, proof of date of birth, etc., the presence of ghost agents have reduced 12% year on year, leading to an estimated \$1.2bn in government savings.¹⁹ In addition, DPI improved the government's ability to collect and analyse data on beneficiaries' income and consumption patterns, allowing for better-targeted interventions. Without the presence of ghost agents and an increase in information provision, the supply and demand curves for LPG subsidies mapped onto the MSC and MSB curves respectively, indicating an allocatively efficient use of the subsidies.

This was brought to life by interviews with informal workers working in households, as vegetable vendors, and tea stalls around Mumbai. They all had clarity and confidence from the fact that their families, even in remote villages, were receiving subsidies for LPG into their Aadhar linked bank accounts.

Concerns

There are some concerns that need to be addressed for DPI. First, when governments are given access to users' data, they can of course use it as discussed above for more efficient benefits transferring. However, there is also a risk that having such comprehensive data can be used for **undue control** and political gain. They may, for example, divert subsidies away from individuals who oppose them and withhold or limit access to public goods and services like food and housing. Such practices not only undermine the principles of fairness and equality but also erode public trust in government institutions. Access to detailed demographic and behavioural data also allows for targeted political campaigns, where specific voter groups can be manipulated through personalized messaging or incentives, skewing the democratic process.

Second, a lot of the benefits of DPI is dependent on having smartphones, reliable internet connectivity, and digital literacy. This has created barriers particularly for elderly informal workers or those who are unable to afford smartphones (e.g., as is the case for many workers on construction sites).

Third, while some of its advocates believe that DPI can be an all-encompassing solution, it cannot solve for deep rooted information barriers and asymmetries. For example, though the Direct Benefit Transfer (DBT) system has made substantial progress in ensuring that subsidies reach the intended beneficiaries, a large proportion of informal workers continue to receive their wages in cash. According to an empirical study focused on Aadhaar use among informal workers in Chennai, a city in South India, employees did not know as much about employers and working conditions as employers knew about them. This may mean they enter into wage and employment agreements under false pretences, potentially reducing either their bargaining power or the utility they derive from doing the work. The report also showed 62% of these workers receive cash payments, which leaves them vulnerable still to wage theft and underpayment. 45% of those workers experienced delays in receiving their wages, and nearly 20% reported wage theft despite being registered under Aadhaar.²⁰ The report further pointed out that many employers used Aadhaar-linked benefits for reducing cash wages, arguing that the benefits compensate for the lower pay.

This theme of being paid in cash was being reinforced by interviews with street food vendors who said that although many customers pay for their services digitally and they enjoy the transparency money coming in, much of their own expenses are done in cash. They expressed concerns about relying too much on what is perceived to be an opaque technology platform controlled by the government and large companies.

These issues highlight a critical gap in the potency of DPI: it does not fully protect informal workers from exploitation, and in some instances fails to address the broader structural issues that keep such workers in precarious employment situations.

Future Possibilities

So far, DPI have clearly been successful in facilitating access to benefits like food subsidies and LPG connections. They still, however, are yet to substantially improve informal workers' access to income and growth. They have, however, started to implement programmes that address these issues.

The first objective is to improve and substantiate the relationship between employers and employees. Digi-Locker, an app linked to the Aadhaar database, provides a secure digital wallet with authenticated documents relating to education, health, drivers' licences, and other important data. This helps potential employers get more confidence in informal workers' abilities.

The second objective is to improve access to markets and job opportunities. For example, some potential has emerged in enabling small shops, artisans, and taxi drivers to use the Open Network for Digital Commerce (ONDC), where the number of sellers has increased from 122,000 to 580,000 and the number of transactions 6x in just a 12-month period from June 2023. This has enabled these informal workers to access a wider customer demographic and enter national markets at 50% of the cost selling through incumbent e-commerce platforms like Amazon.²¹ There are

also digital platforms emerging e.g., Unified Logistics Interface Portal (ULIP) which is creating opportunities for informal workers in the transportation and warehouse sectors.

Finally, informal workers can use these platforms to document their transaction data. This has in turn increased their access to credit (e.g., automatic loans have been made available to transporters based on the FastTag DPI- which measures how many times vehicles go through toll booths through scanning a QR code with their vehicle registration), as these transactions are a more reliable indicator of the health of their business. While all of these are in their initial stages, they could be a powerful enabler for informal workers in the year to come.

To conclude, DPI has so far proven to be most effective in improving benefits targeting but have not yet unlocked their potential in creating new sources of income. Safeguards on government controls on privacy need ensured (like the recently introduced Data Privacy Bill) so that DPI does not just reinforce existing social power structures. DPI is an important vehicle towards achieving more Pareto-optimal outcomes and a more equitable society that will benefit millions of informal workers in India.

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