

# Multilevel Framework of ICT for Improvement in Public Distribution System for Developing Countries

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## Abstract

Some developing countries are facing severe problems now days which are hindering their speed of development and future prospects. There is unrest in citizens for public institutions due to corruption, less accountability and non transparency in government process. One of the burning problems which add more to existing problems is conventional Inefficient Public Distribution System which further makes public policy implementation inefficient due to absence of ineffective and inefficient or no feedback mechanism. Conventional PDS mechanism is viewed as linear transmission systems of benefits delivery. This PDS is top-down process and hence struggles with quickly adapting to market dynamics and globalization. In this paper prospect for social innovation with ICT emerges at the dynamic intersection of informal, conventional PDS, top down approach of services and goods delivery of the systems in the developing world. With the demographic changes developing countries are experiencing more demand of government benefits in social or infrastructural sector so it is time to utilize the ICT tools and mechanisms to improve conventional PDS systems which is free from the severe loopholes of leakage, unaccountability, non transparency and no feedback mechanism from bottom to top in timely manner. New solutions needs to utilize potential of ICT in three aspects: to increase ease of access and relevance of material through its integration into the PDS, To remove or reduce leakage and to introduce a feedback mechanism loop that enables players at all levels of the PDS and System itself to actively contribute to solutions of problems evolving constantly with dynamic changes. In this paper we are proposing Multilevel ICT enabled public distribution system model which can be implemented with the already existing PDS to remove ready existing problems in conventional PDS. Two models on platform of ICT are proposed for developing countries having ICT enabled identification system of citizens and the countries not having unique identification platform based on ICT. With the help of models, Paper is providing very effective and efficient way of benefit transfer and feedback mechanism. This can be easily implemented in developing countries if country is having exposure in ICT like India, Brazil, South Africa, Mexico and others.

**Keywords:** ICT Public distribution systems, Leakage, Benefit transfer, Feedback mechanism, UIDA

## 1. Introduction

Public Distribution System (PDS) consists of government, beneficiary as citizen and government machinery layer and representative of the people working as mediator. This system is hierarchic system which is used for distribution of government benefits to citizens. These benefits include food grains, scholarships, fertilizers, energy assets and subsidies and other benefits too. These benefits amount to be very large in volume as well as in cost for the government. For instance developing country like India is spending large amount of funds of Rs. 15,000 corer 18 percent of GDP which means distribution must be ensured accurate and efficient without loopholes [7]. Social welfare schemes are very much needed in developing country because development may be exclusive even after the effort being made to make it inclusive which would further divide society by creating sufficiently large gap between population groups and may create social internal imbalance leading to imbalanced society [7]. Developing countries most of the times have three tier of government system with central government, state government and local government representatives. For instance Government of India is managed by jointly with state governments. It distributes subsidized food and non-food items to poor population of India [6]. Major commodities distributed include staple food grains, such as wheat, rice, sugar and kerosene through a network of public distribution shops, also known as Ration shops established in several states across the country. Food Corporation of India (FCI), a Government-owned corporation, procures and maintains the benefits to be distributed as food grains for Public Distribution System [1]. The PDS has been criticized for its urban bias and its failure to serve the poorer sections of the population effectively and efficiently. The targeted PDS is costly and gives rise to much corruption in the process of extricating the poor from those who are less needy.

For instance today, India has the largest stock of grain in the world besides China, the government spends Rs. 750 billion (\$13.6 billion) per year, almost 1 percent of GDP, yet 21% remain undernourished [1]. Central government is responsible for procurement, storage, transportation, and bulk allocation of food grains while state responsibility is for distributing the same to the consumers through the established network. State governments are also responsible for operational responsibilities including allocation and identification of families below poverty line (BPL), issue of ration cards, supervision and monitoring the functioning [3]. Distribution shops locally are known as "ration shop" and chiefly sell wheat, rice, kerosene and sugar at a price much lower than the market price. However, other essential commodities may also be sold. These are also called Fair Price Shops. For buying items from this shop one must have a ration card. These shops are operated throughout the country by joint assistance of central and state government. No doubt the items from these shops are much cheaper but are of poor quality. Ration shops are now present in most localities, villages' towns and cities. India has 478,000 shops constituting the largest distribution network in the world. There is no denying to the fact that PDS is suffering from structural as well as procedural problems. In spite of having production more than required quantity, population is suffering only because of inefficiency in distribution and storage facilities of food grains [1]. Same problem is due to non evenly distributed benefits, not inclusive development of banking system in marginalized or tribal area which are severely affected and are in dire need of benefits from government [3]. Ghost beneficiary are large in number which can only be avoided with biometric public distribution system [1]. Total benefits do not reach to deserving population or reaches in very small quantity. Leakage and diversion in PDS is to this extent that for every Rs. 4 spent on PDS, only Rs. 1 reaches the poor, 57% of the PDS food grain does not reach the intended people [9]. No feedback mechanism is there to ensure that total benefits with in time frame have reached to needy persons. Deployment of path breaking technologies would make the system more robust effective and sustainable [10]. Due to this ineffectiveness and loophole in the process and structure, government is losing more money, large resources or wasting them. Conventional model of existing system is here which can be improved with the inclusion of structural changes and procedural alteration with the aid of ICT [8]. Door delivery and housing of FPS in public buildings though shall incur additional costs it is estimated to save around Rs. 4197 crore annually by plugging in the leakages[11]. Other option is to give subsidy on km basis so that FPS owners themselves shall mobilize the resources for logistics efficiently with in ICT framework. Channeled through special Food Price

Shops, the PDS will potentially be amplified to guarantee food and other benefits for two thirds of the population. However, there are several problems with this massive system, including the fact that it is riddled with corruption: shop owners are notorious for stealing and over-charging, the already malnourished beneficiaries of the system often receive poor quality food grains, ration cards are traded for money and heavy bureaucratic procedures prevent many poor citizens from obtaining ration cards and more important is leakage and delay [6]. Despite having the capacity to export some of the produce, only 40 per cent of food grains reach Indian homes at the end of the supply chain [7].

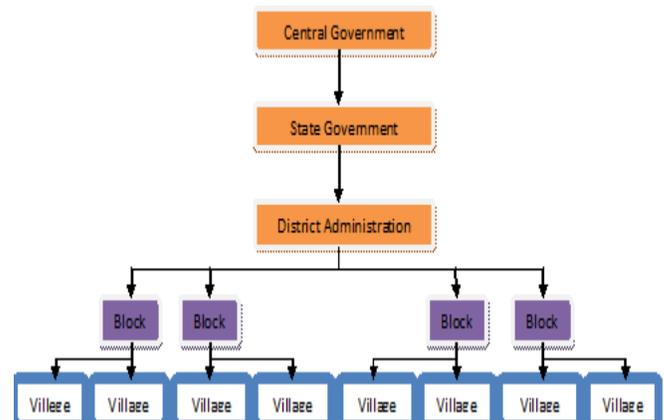


Figure 1: Conventional PDS system

Proposed model try to solve above mentioned problem with the use of Multilevel ICT framework in PDS. Convention mode implemented in various developing countries has been shown in figure 1 specific to India.

## 2. Discussion - Proposed model

It is important to develop ICT model which can solve the bi problems in PDS which is back bone of benefit subsidies transfer from government side in developing countries.

### 2.1 Improved PDS with Multilevel ICT Framework

Conventional PDS is suffering and causing great pain to policy formulators as well as implementers due to problems off leakage, ghost beneficiary, linear unidirectional flow of information and no feedback mechanism [2]. Proposedmodel has four level ICT centres with modern facilities of connectivity and human resources for recoding feedback and responding to query working as call center. Call centers strength depends on the load of benefits being distributed. They are connected with executive functionary of central, state and local government and storage facilities storing benefits such as food grains, fertilizers or even funds. Especially examples of Indian public administration

system and of their tier government are being taken which can be customized according to the suitability of developing Mobile No and other information stored

countries [5]. Information of beneficiary is stored in Databases with centre government.

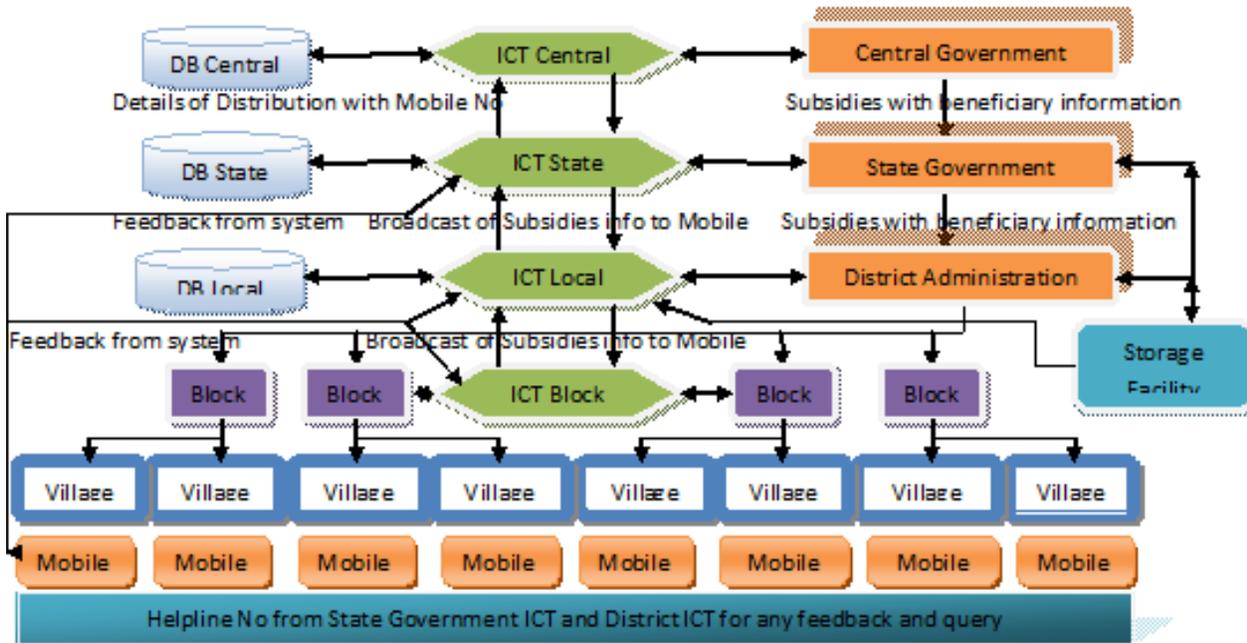


Figure 2: ICT enabled public distribution systems model

Access is shared with state government and local district authorities for identification of targeted beneficiary. State government and central government and district authorities ICT centers are connected to storage facility. Quantity and transfer units are decided by state government and information is directed to Storage facility through ICT state component of framework. ICT district and Block get information of distribution charts and schedule and other information from ICT states component. ICT states component is directly getting directions and required information from center government and state executive machinery. District authority broadcasts the plan of subsidies distribution for particular area using ICT block center so schedule is known to beneficiary with quantity place of distribution and quality as well and other relevant details through messages as well as call on the mobile device of each person or one on village sarpanch. This makes timely availability of information. Exact quantity amount food or subsidies is transported from storage facility. Nutritional value and other checks are done on distribution sites. Helpline numbers are given by state government ICT center through District or block using broadcasting. This helps in making an inquiry or complains about the quantity of food, quality of food, management of distribution system process and officials involved in the process. So now complains are directly available to higher authority and no intervention is there of middle

executive and hence corrective measures are legitimate and truthful. Flow of information is bidirectional which makes system more responsive and accountable. Leakage is not there as information is timely available at various places like ICT Central, ICT State and ICT District

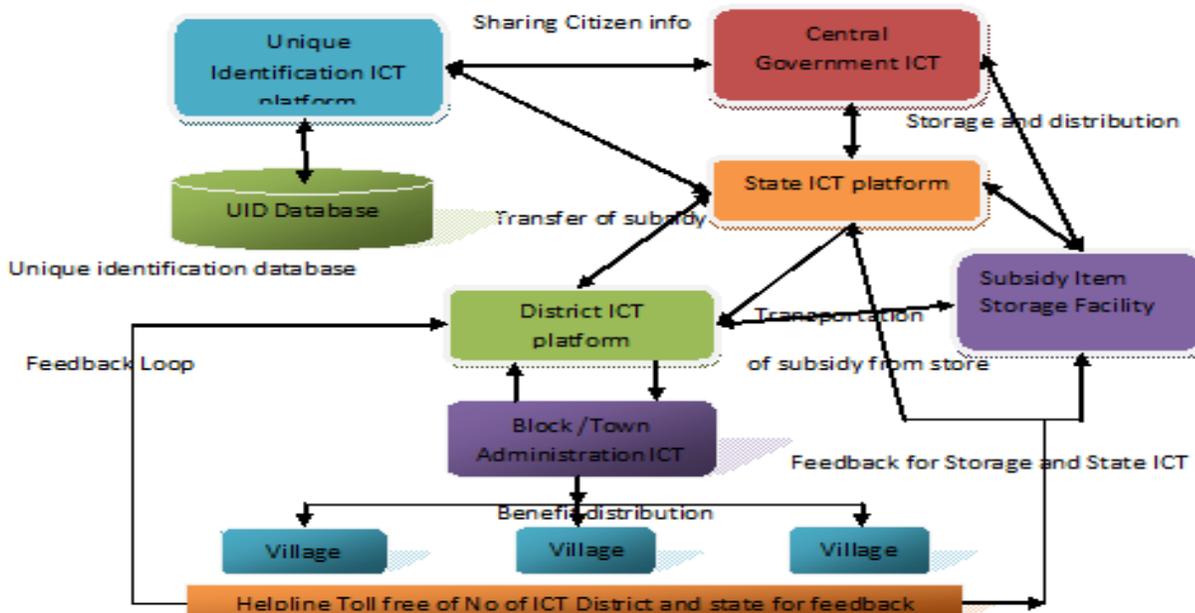
### 2.2 ICT PDS with Existing UID and ICT platform

Some of the developing countries have ICT enabled storage of information of their citizens. We are calling that Unique Identification Authority Platform. Some of the countries are trying to accomplish those systems in time. Where population is large, in those developing countries it is little bit difficult to have such system and maintenance of it. India is also trying it with AADHAR which is being implemented with the assistance of the planning commission of India. This model is with enhancement to that ICT functionality and integration with ICT platform. Model is shown in Figure 3 where UID citizen information like address, mobile no, emails, poverty status or other relevant information is being shared by State and central government. Subsidy information is shared by ICT platform of Storage facility with District, State and central ICT framework in order to make arrangement of transfer and calculation of benefits to each district and block according to the directions received by state government. Subsidies transported to blocks and districts are now checked at each point on real time with the help of ICT centre of district, block, state and central and report are prepared

accordingly. If some discrepancies are found then corrective measures are taken. District ICT center broadcasts information related to subsidy distribution to the mobile or other contact information of beneficiary by accessing data from UIDA, Unique Identification Authority. Beneficiaries gather at designated place informed by district/block authority through broadcasted messages for subsidies. Subsidies are distributed in time bound manner. Information about quality of the food grains, fertilizers and other subsidized items are also

broadcasted which make sure that food or other benefits are according to the guidelines. Help line no for any query to beneficiaries are also conveyed from state ICT center which deals with complaints of leakage, ghost beneficiary or low quality food distribution or process related any other problem. State government is informed by ICT center and due to timely availability of complained and information about the process, corrective steps of improvement or punishments are taken accordingly.

**Information of Citizens their contact and residence**



**Figure 2: Multilevel ICT Model in case of ICT enabled platform for information of citizen**

**3. Observations**

ICT Multilevel Models with modification upto district level was implemented within the constraints and results and facts were collected. This was implemented in one village of one block with district authorities. Help of one NGO was also taken for workforce and other logistics [4]. We collected the information and feedback on two fronts which are being discusses point wise.

**3.1 Removal of leakage**

Comparison with the conventional PDS systems has shown some bright results. Leakage is dramatically and sharply gone down at each level of communication. It is because of shared information, directions about the systems and process was timely available and respective authorities were informed about the status of the subsidies and transfer of that to other component involved in the PDS. This has been shown in the table 1

in which 1000 Kg of food grains was transported and ICT enabled system was followed from district to village no upper authority was involved in this demonstration. From table it is quite clear the improvement in the system leakage. It is now less than .35 percent which was around 41.2 percent in conventional PDS.

Subsidies	Quarter 1 in Kg 1000	
	Conventional	ICT PDS
Wheat	148	1.5
Rice	136	1
Fertilizers	128	1
<b>Total</b>	<b>412</b>	<b>3.5</b>

**Table 1: Comparison of leakage for one village**

Some of the leakage is due to transportation issues like bad roads and packaging which was also occurred in ICT

enabled PDS but other manual leakage has been reduced to very low level.

### 3.2 Feedback mechanism

Conventional PDS is mainly linear and manual in storing information and transmission of information which is problematic. Information can be altered at lower distribution authorities as per their convenience. This creates scope for no improvement. ICT enabled systems have overcome problems of feedback mechanism. Due to integration of ICT center at each level of governance and transfer of relevant information on ICT tools has improved the process in time and response time as well. It has also one dimension in getting feedback directly beneficiary about their problems/suggestions related to quantity distributed, quality of benefits, time and schedule or any other thing directly to higher authority which is state in this case without tempering of information by middle or lower government executives. Firstly this helps in getting correct feedback. These can also help the policy implementers and formulators to design area specific policies or readressal of problems of beneficiary. Table is showing data obtained from beneficiaries of the particular village and their problems. It is in comparison with the conventional PDS feedback process which is actually separate task.

But in ICT enabled it is incorporated inside the system and hence improved the response time as well as other issues.

Transition of Feedback		Time Taken in Hours Max	
From	To	Conventional PDS	ICT Enabled PDS
Village	Block	48	0.10
Block	District	40	0.10
District	State	68	0.10
State	Central	84	0.10
Total Time		240	0.40

Table 2: Time in Feedback

### 4. Conclusion

Proposed models imply the broad applicability and potential for social innovation at the dynamic intersection of informal, conventional PDS with ICT platform, top down approach of services and goods delivery of the systems in the developing world.

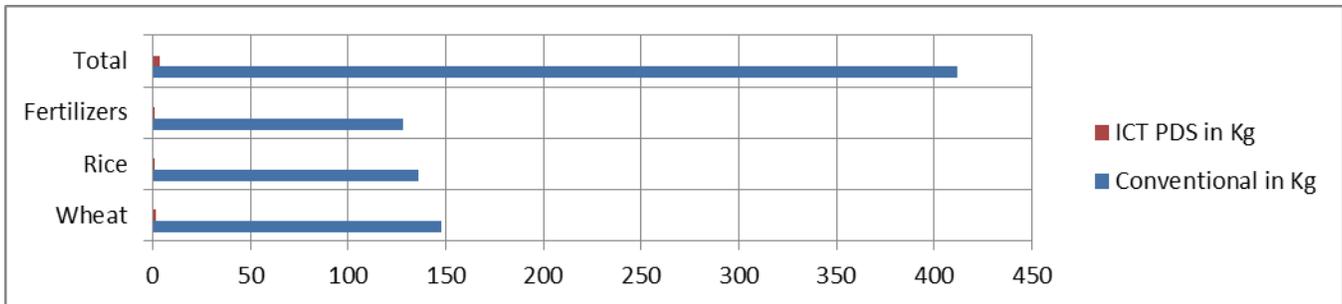


Figure 4: Comparison of leakage for one village in Conventional and ICT PDS

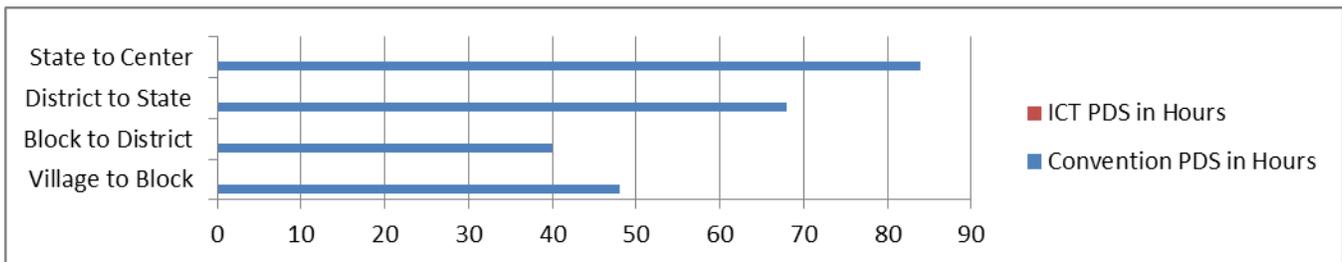


Figure 5: Comparison of time taken in feedback mechanism in Conventional and ICT PDS

ICT enabled model is a solution in improving the storage system by having information timely available and it also improves the distribution system with very less leakage off the subsidies in the process and timely delivery of subsidies and other public goods and services. Tracking of material is facilitated by GPS on the vehicle which is reducing and maintaining check of quality and quantity of the material being delivered. With the implementation of the prototype, it helps in expenditure and cost reduction as now leakage and waste of resources is less or zero. Credit benefits transfer is so smooth with the banking systems that the stock holders, government can directly transfer amount to beneficiary. This feedback mechanism is helping in improvement of distribution process as well as in new policy formulation according to the requirement of real issue being faced by society. These issues could be in terms of scarcity of resources, nutrition, health and education. However the challenge that must be overcome before successful technical implementation include providing ongoing technical support, human resources, reliable power supply, hardware/software upgrades and maintenance at each step of ICT center. This Multilevel model has been tested on one village, block and district which proved successful. It can be scaled to states and countries depending to their requirements.

## 5. Future Directions

This model we development can be enhanced according to country specific or local conditions specific needs. If persons have access to banks or any financial institution then they can bank can be made one component in this model by providing funds directly to the account of beneficiary and transmitting information with the help of developed prototype. Tracking of movement of food can also be included in the model. GPS tracking of the PDS delivery trucks, which would reduce the diversion of PDS commodities, could be very helpful.

## REFERENCES

- [1] ArnabSaha, Chaitanya Tarun Mohan, Rahul Daga” ISSUE PAPER On Public Distribution System in India”[http://www.academia.edu/378216/Public\\_Distribution\\_System\\_in\\_India](http://www.academia.edu/378216/Public_Distribution_System_in_India)
- [2] B. Sen, "Indigenous knowledge for development: Bringing research and practice together," *International Information & Library Review*, vol. 37, pp. 375-382, 2005.
- [3] R. Howitt and S. Suchet-Pearson, "Rethinking the building blocks: ontological pluralism and the idea of "management" *GeografiskaAnnaler: Series B, Human Geography*, vol. 88, pp. 323-335, 2006.

- [4] "RUDI-SEWA: rural distribution network documentation of best practice," OneWorld Foundation India2010.
- [5] S. Garguilo, M. Prindible, A. O. Syata, and K. Mehta, "Labor hiring practices and produce supply chains in rural Kenya: The case for WashVast networking," *International Journal for Service Learning in Engineering*, vol. 5, pp. 111-127, 2010.
- [6] R. Duncombe, "Using the Livelihoods Framework to Analyze ICT Applications for Poverty Reduction through Microenterprise," *Information Technologies and International Development*, vol. 3, pp. 81-100, 2006.
- [7] Vijay Paul Sharma "Food Subsidy in India: Trends, Causes and Policy Reform Options" W.P.No.2012-08-02 August 2012 <http://www.iimahd.ernet.in/assets/snippets/workingpaperpdf/5337679172012-08-02.pdf>
- [8] Antonio Cordella Carla Bonina "A Public Value Perspective for ICT Enabled Public Sector Reforms: Atheoreticalreflection"<http://www.antoniocordella.com/media/GIQrevisedFINAL.pdf>
- [9] Contini, F., &Cordella, A. (2007). *Information System and Information Infrastructure Deployment: the Challenge of the Italian e-Justice Approach. Electronic Journal of E- Government* 5(1).M.
- [10] Tsuda, K. I. Takahashi, M. Hara, Y. Nemoto, J. Nakamura, S. Nishi and M. Takaoka, "Index to evaluate contribution of ICT services for realization of sustainable society", *Proceedings of 2007 IEEE International Symposium on Electronics and the Environment*, pp. 16-18, 2007.
- [11] *Performance Evaluation of Targeted Public Distribution System, Programme Evaluation Organisation Planning Commission Government of India New Delhi March 2005.*
- [12] Dilip I. Thakor, Pankaj P. Prajapati, "A 11.8MW Low Noise Amplifier for 3-8 GHz Wideband application", *IJCEM*, vol. 15 issue 2, March 2012.



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