

Description of the INNOVATION

Main category(ies) of innovation:

Several choices are possible (double click to access the menu and select activated box).

Technical / technological

Social

Economic

Institutional

Other. Specify :

Innovation Terrain:

Country/location(s) where the innovation is observed/analyzed

*In Bangladesh, particularly in the **Division** of Rajshahi. Its use is strongly promoted by the Ministry of Agriculture through the Barind Multipurpose Development Authority (BMDA)*

Innovation title:

1 sentence

*Introduction of Prepaid meter **and Smart cards** for pumping system in the irrigation field*

Summary:

Brief description : 10 lines max

It is a computerized automatic irrigation charge collection system. This technology allows farmers to access irrigation water on demand and within their means. Pre-paid pumping systems are particularly used for groundwater abstraction via collective boreholes, but also on collective motor pump systems drawing directly from canals (khals)

There are two parts of the Prepaid Metering System:

- *The Prepaid Meter **& Smart Cards**, and*
- *The Database Server and Networking system.*

*The Prepaid meter is also a energy measuring unit which work in different modes like (i) Power consumption mode – It will deduct money according to power consumption, (ii) Time consumption mode – It will deduct money according to time consumption.**(also discharge capacity of pumping unit)***

1. The Prepaid Meter:

Prepaid Metering System every farmer contain a user card which is embedded with his photo, name and a user number which is provided by BMDA. Then for every pump station they use a prepaid meter with a LCD display which is hung on after the energy measuring meter. They initial the prepaid meters consuming mode like power or time tariff using an initial card. The farmer will be able to charge an amount of his choice from the local BMDA offices or from a dealer or

distributor. Each local office will have a Vending Station (VS) and each vending dealer will have a Mobile Vending Unit (MVU) for facilitating the charging of cards of the farmers.

The farmers /users go to the respective vending dealer and place his demand (how much money he wants to charge in his/her user card). After charging money s/he goes to his respective pump house and inserts his card in the meters slot. Then the meter starts automatically. After fulfilling his demand he presses the button on the meter and pulls out his card back. After one or two days interval a responsible person of BMDA goes to the pump station and insert his checking card in the meter's slot and the meter automatically upload the whole information of previous pump operation. That is how the responsible person of BMDA knows the whole information of pump usage.

If it is necessary to change the tariff mode or tariff rate of the meter like time or power tariff or discharge, then it is possible to change the parameter by using parameter card. The initial card or parameter card is provided from the head office to the upazila (zonal) office of the respective district.

For continuous updating and monitoring of the collected data, all VS will be connected to a System Master Station (SMS) to be located at Head office of BMDA. Therefore the Head office will automatically be able to know all vending information. The daily sales report, weekly consumption report, dealer-wise sales report etc. can be generated from the SMS. Other than the report generation, the overall control to the VS will be maintained from the SMS.

2. The Database and Networking System:

To store the whole data like: user information, charging information, meter information etc, BMDA use a central server which is called SMS (System Master Station). For storing the whole data there is a database called SQL Server and for charging the user card they use database software called PMS (Payment Management System).

The sever computer is established in head office of BMDA. Every upazilla office contains VS (Vending Station), which is a computer and connects with the SMS through telephone line. The VS is used for charging or uploading the meter information. To collect the information from VS to SMS we use internet facilities. They called this procedure internet networking or Virtual Private Network (VPN).

Emergence of innovation:

Name of the inventor or the bearer of the innovation or any other details on the origin of the innovation (research-action project, development project, institutional, associative or private initiative...)

The Pre-paid system on Irrigation charge is first introduced in **Barind Multipurpose Development Authority (BMDA)** throughout Bangladesh which is one of the different types of Organization in the Bangladesh which are related to irrigation, like Bangladesh water development board, (BWDB), Bangladesh Agriculture development corporation (BADC).

Fixing of the irrigation charge and its collection was very complicated process in most of the developing countries especially in the southeast Asia. Resulting the financial viability and sustainability of the irrigation system was a big problem. BMDA tried different systems like charge on unit of irrigated land, irrigation Charge coupon of different monetized values for supplying irrigation water, but no system was proved to be a leakproof. The different systems were tried/trialed since 1985 till 2004. Finally, in 2005 few engineers of BMDA had long brainstorming sessions how to address the problem. BMDA authority's engineers gave the commitment to Ministry of Agriculture that authority will operate irrigation equipment on the basis of self-financed model. Self-financed

means earnings from irrigation pumping units will meet the total O&M costs. The O&M cost includes- operation and maintenance expenditures, electricity bills, replacement of irrigation pumping units, salary and wages of the total technical and non-technical staffs and retirement benefits of the total employed manpower.

A group of dedicated professional technical and experienced irrigation management personnel of around ten numbers had threadbare discussions and pros and cons of different system were placed on the table for final decisions in 2005. Most of these dedicated thinkers, planners and executors for the system were from the project areas. The main policy developers and thinkers included the following personnel:

- 1. Dr. Asaduz Zaman-Irrigation Engineer and CEO of BMDA, the main thinker and policy developer*
- 2. Mr. Khalequzzaman- Senior Mechanical Engineer- member of the think tank and implementing Team.*
- 3. Mr. Sultan Mahmud Sarker- Senior Mechanical Engineer- member of the think tank and implementing Team.*
- 4. Mr. Abu Taleb Bhuyan- Senior Irrigation Engineer and critical analyst of the different irrigation systems.*
- 5. Mr. Tofazzul Sarker- IT Engineer*
- 6. Mr. Moinuddin Ahmed- Senior Electrician*

In fact, later Asian Development Bank (ADB) hired most of the above personnel for their experienced services to replicate in other irrigation projects in the region- in Bangladesh, Nepal and India.

BMDA is created on 15th January in 1992. From the inception BMDA acts on development of surface water, ground water lifting by DTW for the purpose of irrigation, development of rural roads/culverts/bridges/cross dam construction, Khal/khari/Pond re-excavation and massive plantation and so on.

BMDA is the first organization that has introduced the Prepaid Metering System for 3-Phase electric line. The prepaid meter system which currently extends over 124 Upazilas of 16 districts is managed by BMDA. Repairs to the system, for example for the 16,072 Meters, are done under contract with a private company (currently Sanakosh Associates Ltd). The system was supplied and installed by Wasion Group, China.

Describe the elements of the local context that explain the emergence of the innovation: initial problem, constraints/opportunities, possible significant events...

Barind Authority charges money from farmers for Irrigation. Formerly, to realize Irrigation charge coupon system was used in the field. Prepaid Meter system started in 2005 for eliminating some of the problems like- take coupon, problem of coupon preservation, financial cheating to the farmers etc. In this system there is a prepaid meter set to every deep Tube well . Prepaid card is supplied every farmer with his picture and a user number. Required number of dealers are appointed from every BMDA office for respective Upazilla. There is a vending machine to every dealer. So dealers use to recharge money from Upazilla office of BMDA as required, Similarly, farmers can recharge there card from dealers then take water by inserting the recharge card in the slot of Prepaid meter. In this system there is no chance of misappropriation of money. Irrigation charge and wastage of water have been reduced and finally the financial cheating to the farmers has been stopped.

Solution(s) provided by the innovation:

Describe the impacts and beneficiaries of the innovation

- *Pre-paid meter is a well-equipped and distinctly displayable data base meter. From this, one can read the operating hours, total operating hours, unit consumption per hour, total taka against total operation and so on at a glance. it is then very convenient and technically easier than post-paid energy meter.*
- *It is organized by computerized system. So it can easily transfer the data from its memory to check card/parameter card. Accountability is then very much obvious, distinct and precise.*
- *As this meter runs only by inserting charged pre-paid card, there no scope of irrigation without pre-paid card.*
- *all water provided is paid for in advance;*
- *there is no opportunity to by-pass the meter;*
- *the system is completely transparent with checks and balances in place to counter fraud;*
- *People cannot coerce the operator to deliver water free of charge;*
- *Farmers cannot be exploited by land owners who may control the well;*
- *As it is possible to check the pre-paid meter by checking card, close monitoring is established.*
- *As this system has direct control on DTW operation (Deep Tubwell irrigation), there is no scope of the land owners to exploit the helpless small and poor farmer*
- *In this system one could run many DTWS at a time*
- *No misunderstanding or no bargaining will is created from the operator at the time of unit certification by SSAE/SAE/Asst. Mechanic/Mechanic.*
- *service status is upgraded because of high technology.*
- *Prepaid water charges go to BMDA coffers which support the sustainability of the BMDA*
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Customers benefit are:

- *customers like the new system*
- *easy and transparent*
- *they can control their own consumption*
- *they can control their budget*
- *there is no minimum charge*
- *require no deposit*
- *no more disputed bills*
- *automated record keeping*

The water service provider benefits are:

- *upfront payment,*
- *improved cash flow,*
- *lower overheads expenses (no meter reading or billing),*
- *increased revenue,*
- *no outstanding*
- *tamper protection*
- *better customer services*
- *automated record keeping*
- *create water saving attitude to the consumers*

Evolutionary history since emergence (field implementation)

Describe the constraints, the difficulties encountered, and the key stages in the evolution of the innovation up to the present day.

Zamn any idea

The financial viability is the very important aspect to achieve the sustainable irrigation systems especially in developing countries. So different type of constraints were surfaced during planning and implementation period especially in the initial stages. These constraints were of different natures like-technical, financial, social and political. These constraints are as follows:-

- (i) **Technical**- No body has any previous experience anywhere in the irrigation projects. Even when the tender for supplying and installation of the pre-Paid metering system was floated in 2005, the bidders from India, China and Malaysia participated. They did not have clear views how to go ahead but they wanted to proceed with their technical knowledge. They presented different scenarios and were asked by BMDA to demonstrate in the deep tube well in the field. One bidder requested for extension for demonstration and other two from India and China participated in field demonstration. Indian display faced few technical problems, and requested for extension. The Chinese firm showed practically the pumping started from tube well and money being deducted. Utter surprise, the Chinese experts were not good at all in English understanding or speaking but they showed successfully to BMDA engineers. And still this Chinese firm is supplying, installing and maintaining the irrigation field.*
- (ii) **Financial** - As BMDA planned to undertake this concept of Pre-Paid meter as a experiment/trial stage, they could not submit any project proposal to government. CEO of BMDA decided to proceed with their project's savings. Initially 500 tube wells were selected near the head office so that any problems cropped up during operation could be addressed immediately. Two Upazilas were selected with around 450 nos. of tube wells to keep 50 nos. of pre-paid meters in stock to meet any emergency services.*
- (iii) **Social** - The common farmers were not willing to accept this new concept and practice of Pre-aid metering system. They always prefer to stay with previous practice whether it has positive or negative impact. However, with lot of group discussions they agreed to see the result for one irrigation season. After the irrigation season was over, they were convinced. But the operators of tube wells and group managers were very much reluctant for introduction of the new system as their self interest of earning undue advantages by manipulating the operation period of time and collection of irrigation charges. But when afterwards the common farmers saw that their less amount of money being spent per unit of irrigated land. The farmers are now very cautious to take more irrigation water than their requirement. Irrigation efficiency has increased dramatically.*
- (iv) **Political** - Those self- interested vested groups from different tube wells of those two Upozillas did convince their political representatives that the new concept of pre-Paid meter will be the major cause of honorable Member of Parliament (MPs) defeat in next election. The Member of Parliament approached to BMDA authority and pursued for not installing the Pre-Paid metering system in their constituencies. However, MPs were reluctantly convinced for installation to see at least for one season. After one irrigation season, MPs observed that common farmers are so happy with less expenses for irrigation and finally he cheered the BMDA engineers for introduction of new concept of Pre-Paid metering system. Now, the scenario is totally opposite, in all areas the MPs request why BMDA is delaying to install pre-paid meter in the newly sunk tube wells. Presently, hundred percent tube wells are operating with Pre-paid metering system.*

Successive adaptations, highlights, observed results

Several thousand prepaid pumps have been installed in Bangladesh and tens of thousands of prepaid cards have been distributed to the beneficiaries of the infrastructure. Analysis of different parameters of irrigation system shows a very good picture after installation of prepaid metering system and smart cards. A detail comparison study was undertaken in the BMDA project areas with BMDA operated and managed tube wells the scenarios in table 3 shows what a dramatic positive changes have been taken place.

The following table 3 shows the impact after installation of prepaid meters.

Parameter	Before Pre-Paid	After Pre-Paid Meter	Comparison
Irrigation Cost/ Ha. (BDT)	11,040	5,440	51% improvement
Irrigation Cost/Ha. (USD)	138	68	51% improvement
Average Water use/Ha. (Inch)	82	59	28% improvement
Water Required /Kg of Boro Rice production. (Liter	3400	2250	34% improvement
Avg. Yield / Ha. (Kg)	6,084	6,602	34% improvement
Avg. Earning /Ha. of Boro Rice (BDT)	31,200	44,480	43% improvement
Avg. Earning /Ha. of Boro Rice (USD)	390	556	43% improvement
Irrigated area / Well in Ha	30	39	30% increase
Nos. of water users/ Wel	70	89	27% increase
Irrigation Charges/ Well in BDT	254,960	286,560	12% increase
Irrigation Charge/ Well in USD	3,187	3,582	12% increase
Annual operating hours /Well (Avg.)	2,884	3,132	9% decrease
Annual Electricity Bill /Well in BDT	129,040	117,360	9% decrease
Annual Electricity Bill in USD	1,613	1,467	9% decrease

Source : Participatory Irrigation Management: Barind Model a New Sustainable Initiative ; Center for Action Research-Barind, Bangladesh / Asian Development Bank, Bangladesh, Asaduz Zaman;2019

The use of this system allows farmers to save nearly 30% of irrigation costs (rational irrigation) and reduces water use by nearly 40% (payment by volume consumed). The implementation of this system has allowed an increase in production, a change in crop rotation, while limiting the impact of irrigation on the environment and guaranteeing a 100% recovery rate for pump managers.

The following figures give a detail picture of pre paid meter in BMDA :

- 124 Nos. Upazila under BMDA.
- 15794 nos. of DTWs with Prepaid Meter
- 550 nos. of LLP with Prepaid meter.
- 3 Nos. of DTW, 169 nos. of LLP and 571 nos. of Dug wells are connected with solar panels.
- Where total DTWs 15794 nos, LLPs 601 nos and Dug wells 638 nos.

Users' opinions / elements of acceptance of the innovation:

Describe the key elements of user/beneficiary adoption/acceptance of the innovation

Although coupon system also used in Bangladesh is now well known and reputed, it has some limitations to aid the benefit to the farmers directly. Now Pre-paid meter on irrigation charges give transparency and allow fast accountability at several points, here water rights of a farmer are established by recharging pre-paid card and help less farmers cannot be exploited by landowners or operator or group leader or manager.

Perceptions of innovation evolution:

Describe the identified needs for improvement, the levers of diffusion but also the limits and risks of this diffusion (sustainability of the irrigated system)

The system fail when there is no electricity, but then so do the electrically powered pumps. All the pumps under BMDA are electric pumps. There are issues of reliable electricity but the farmers manage an informal backup system pumping from ponds and khals. Farmers understand the limitations of electricity and some schemes are not fully planted due to the limitations of the number of hours of electricity

Presently, the electricity situation in Bangladesh has improved a lot and special priority for irrigation equipment all over the country during irrigation season. Moreover, BMDA has introduced Solar energy sources for irrigation purpose and it has got priority from the authority management.

Conditions of diffusion of the innovation and replicability:

The aim here is to propose an assessment of the conditions of diffusion of innovation.

Can this innovation be transposed to another territory? Under what conditions (what scale, what context, what types of crops, what irrigated system(s)...)

As Asian Development Bank (ADB) visited the BMDA area several occasions and had discussions with irrigation water users, now they have adopted a policy that for any loan or grants for irrigation projects in few countries like other aided irrigation projects in Bangladesh (Muhuri Irrigation Project for 850 nos. of pumping units), In Nepal (Terai groundwater development project initially for 1000 tube wells), in India (Madhaya Pradesh Irrigation Projects) the BMDA model is already replicated and also being replicated.

Additional documentation

Photos and illustrations:

Paste the illustrations here. The source files of the photos and their credits will be requested at a later stage for the selected files.

All the photo have been taken by Benjamin VENNAT



pre-paid meter install in a collectif pumping system



pre-paid meter install in a collect if pumping system



pre-paid unit card and pre-paid card reload system



pumping system in a khal using pre paid meter system

Pre-Paid Meter	Mobile Vending Unit	Smart Card
		
Card Reader	Data Card Printer	Pump Operator
		

Components of

prepaid meter (Participatory Irrigation Management: Barind Model a New Sustainable Initiative ; Center for Action Research- Barind, Bangladesh / Asian Development Bank, Bangladesh, Asaduz Zaman;2019)

Additional Resources:

Bibliographical references and web links (video, publications, press articles,...)

<http://www.bmda.gov.bd/>

<https://agricultureandfarming.wordpress.com/2013/01/01/prepaid-metering-system-in-irrigation/>

<https://thefinancialexpress.com.bd/national/country/rajshahi-farmers-taking-up-pre-paid-card-irrigation-system-1526020940>

<https://www.hrpub.org/download/20191130/UJM3-12114076.pdf>