

How digital is helping farmers in irrigation: case of auto pump starters using smart phones

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Received: 20th April 2019; Accepted: 20th June 2019

Abstract

This paper deals with one of the digital solutions for farmers (Auto Pump Starters Using Smart Phones) which is simple, yet needs a critical review. In recent past, several organizations started promoting smart solutions to irrigation control through mobile phones. The smart phone based pump starters allow farmers to monitor and operate irrigation pumps for irrigating crops in remote locations. A study was conducted among farmers who have currently installed and are using the auto starters for irrigating their fields during 2017-18. Benefits of Auto pump starters include; relative easiness to operate/ irrigate compared to earlier, time saving, safety and the flexibility of irrigating. More than 74% of the farmers opined that remote accessibility of pump sets using the auto starters was a striking feature. Update about status of irrigation was perceived as an excellent option by 96.3% farmers. Ease in planning irrigation cycles was also found to be an added advantage by 94.5% of farmers. Indirect benefits include reduced water wastage, electricity wastage, labour wastage and fuel wastage (POL). These smart irrigation solutions will help small farmers in a big way. The improvement in irrigation efficiency will also lead to higher yield and productivity in long term.

Keywords: Rice, automated irrigation, auto pump starters, smart phones, farmers perception, digital solution in agriculture

Introduction

Farmers expect much more than access, quality and affordability of knowledge (advisories) and services (financial inclusion, supply chain and marketing) through digital strategies (Shaik N Meera, 2018). The digital models need to take into consideration personalised, exceptional, retail-like experience: time and mission criticalness of extension services. It is about providing these services as how, when and where it is most convenient for them, not extension organizations (Shaik N Meera, 2018). This paper deals with one of such digital solutions (Auto Pump Starters Using Smart Phones) which is simple, yet needs a critical review.

Agricultural industry is the largest employment sector in India; about 64 million hectares of operational holdings have access to irrigation facilities, with over 60 per cent of the irrigated farmland relying on pumped ground water (Sinha, 2016).

At individual farmer's level, a major challenge is effective management of irrigation activities. Significant time and energy is required for frequent trips through hazardous terrain to operate remote water pump systems. This

difficult and costly process leads many farmers to neglect daily pump management activities and leave their pumps running, causing substantial waste of water and electricity, erosion and lowering of soil quality.

At systems level, water use efficiency is significant in agricultural sustainability. For example, the world produces approximately 700 million tons of paddy rice each year. This is enough to provide the staple food for more than three billion people, of which some 700 million live in poverty (Bas Bouman, 2018). On average, the world's rice fields use some 1,400 litres of water by evaporation and transpiration to produce 1 kilogram of paddy rice which is on the same order of magnitude as what wheat uses (Bas Bouman, 2009).

At the field level, farmers can adopt a system of alternate wetting and drying, in which fields are not continuously flooded anymore but are allowed to dry out for a few days in between irrigations. This can save up to 30% of the water while maintaining or sometimes even increasing rice yields. Second is the system of "aerobic rice", in which the field is not flooded at all anymore but just "wetted" like a farmer does with irrigated maize or wheat. Suppose



if we can reduce water use in the world's rice fields by a mere 10%, this would free up to 100 cubic kilometers of water (equivalent to water for 40 million Olympic-sized swimming pools) which is enough to provide half to a quarter of the world's population with domestic water annually.

Traditional manual field irrigation systems need lot of labour and material resources and it goes against the development of long-term agricultural production and sustainable utilization of water resources (Khriji *et.al.*, 2014).

For other crops as well there is a need to adopt the strategies that reduce the water consumption. One of the innovative approaches is using digital solutions that, among many others, would benefit farmers reducing the water consumption.

Auto Pump Starters

Farmers spend all the time in the field to manage their field efficiently to achieve higher productivity but one cannot be successful because of the unavailability of any information. They do not know exactly how much to irrigate at any time. Along with this, a farmer faces one more problem while irrigation that is supply of electricity, because they irrigate their field only when the electric power is available.

Water use efficiency in crops is much talked about concept keeping in view the sustainability for agricultural systems. Automated irrigation system can be used to improve water management. In recent past several organizations started promoting smart solutions to irrigation control through mobile phones. For example, Indian mobile operator Tata Teleservices together with agro-automation company Ossian is helping farmers monitor and switch on irrigation pumps remotely, using a low-end Nokia phone and mobile modem called 'Nano Ganesh' which is connected to the electric starter of the pump. These innovations are literacy neutral as the advisories can also be listened through audio. The system helps to save time, water, and electricity/fuel.

Some advanced features available with such chips / sensors include; Microcontroller based software Technology, Model to suit every single / three phase range, Start stop motor from home or anywhere in world and Electrical safety from all electrical faults. The smart phone based pump starters allow farmers to monitor and operate irrigation pumps for irrigating crops in remote locations. While the public and private sector stakeholders are convinced about the digital solutions, it is important to assess the perception and acceptability of such initiatives among farmers. User

experiences are important when we introduce such digital solutions that involve initial investments on the part of farmers. The assessment of the digital systems in terms of relative advantage over existing irrigation methods would help to further refine and roll out the strategies across the locations. In this context, the present study was carried out in Telangana state of India to critically analyse the grass roots factors that helped use of smart phone based auto starters.

Methodology

The study was conducted among 111 farmers who have currently installed and are using the auto starters for irrigating their fields during 2017-18. The study area is Jagityala district of Telangana, which is purposefully selected due to the fact that a large number of farmers have installed the auto starters recently in this area. The data were collected using survey method and also with focused group discussions. For collecting data, a structured questionnaire was developed with comprehensive indicators. The data was collected during June and July 2018 and the data analysis was done using SPSS.

Results and Discussion

Results of the survey and group discussions are presented in this section. The respondents' age, total cultivated area, automation area and the soil type are presented in Table 1 for general understanding of the context. The respondents are uniformly distributed across different age groups which indicate that farmers, irrespective of their age, have installed the auto starters.

The average cultivated area for the respondents is about 2 ha. It is heartening to note that more than 65 % of the farmers who have cultivated area less than one hectare had installed the auto pump starters compared to only 2.7 % of the farmers having more than 3 ha of land. It is not about the relative large-ness of the landholding that matters in adopting the innovative technologies, rather the relative advantages that are offered by the technology influences the adoption. The proportionate automation area in relation to the total cultivated area was also calculated. Even though few farmers have more cultivated area, not all the area was brought under the auto pump starters. Nearly 85% of the farmers who had installed the auto pump starters tried that in less than 1 ha area. Similarly, 25% of the farmers have used this technology in irrigating 1- 2 hectares area. These pump starters were doing good equally in all types of soils (Heavy, Light and Medium).

Table 1: Frequency of various parameters as perceived by farmers (n=111)

Age in Years	Frequency	%
< 40	35	31.5
41-50	57	51.3
51-62	19	17.2
Total cultivated area (ha)		
a. <1.0	73	65.7
b. 1.1-2.0	28	25.3
c. 2.1-3.0	7	6.3
d. >3.0	3	2.7
Automation area (ha)		
a. <1.0	94	84.6
b. 1.1-2.0	13	11.8
c. 2.1-3.0	4	3.6
d. >3.0	0	0
Soil type (Heavy/Medium/Light)		
a. Heavy	30	27.1
b. Light	26	23.4
c. Medium	55	49.5

Table 2 indicates that about 58% of the farmers installed premium units where as 42% installed basic units. Majority of the farmers (30%) got Texmo make pumps while 25% of the respondents have CRI pump installations. The variety of pumpsets among the users of auto starters revealed that these auto starters could be used for any make. Above 93 % of the respondents reported that they would flood their fields, whereas about 7% of the farmers reported drip irrigation. These results indicate, contrary to the popular belief that auto starters are useful only for drip irrigation; they could also be used in flooded conditions.

More than half of the respondents reported that the pumps are used during the day time and 42% reported that there is no specific time period and they may require switching on the irrigation pumps any time. In India, where the electricity supply is erratic, farmers often walk several kilometers to where their irrigation pumps are located, only to find that there is no electricity available. Very few farmers were using these pumps for fertigation. Half of the farmers having drip irrigation facility were using those systems for applying the fertilizers also.

Factors influencing the selection of Pump Starters are presented in Table 3. One of the interesting factors contributing to the installation of auto starters is the influence of peer group or the organizations. The awareness about the auto pump starters and the availability at the optimum cost is very important in adoption of the innovations. The Farmers' Development Centres of eFresh Pvt Ltd., located in the study area played an important role on creating the awareness about the technology and also

in making the technology available to the farmers. The awareness was followed by the experience sharing and physical examination of the technology helped farmers in selecting the pump starters. The credibility and reliability of Tata brand, the guarantee offered for the products and eFresh brand contributed to the selection of these starters in this area.

Table 2: Frequency Distribution of Respondents based on Usage of Pump starters (n=111)

Parameters	Frequency	%
Name of the pump starter installed		
Texmo	34	30.63
CRI	28	25.23
Varsha	16	14.41
others	33	29.73
Irrigation system type		
Flooded	103	93
Drip	8	7
Sprinkler	0	0
Make of the pumpset		
TQ Basic	46	41.5
TQ Premium	65	58.5
Water source		
Canal	15	13.51
Well open	61	54.95
Storage tank	0	0.00
Bore well	18	16.22
Others	21	18.92
Main power usage period		
Day	61	54.95
Night	3	2.70
24 Hours	47	42.34
Fertigation Done		
Yes	4	3.6
No	107	96.4

Table 3: Factors influencing the selection of Pump Starters (n=111)

Factors that played role in selection (multiple responses) n=111	Frequency	%
FDC physical center	78	70.27
Word of mouth/fellow farmers	75	67.57
Social media (Facebook, Whatsapp)	41	36.94
Reasons for selection (multiple responses)	Frequency	%
TATA Brand	101	90.99
Quality standards	85	76.58
Guarantee	85	76.58
eFresh Brand	69	62.16



Interestingly, the high water consumption crops like paddy and sugarcane listed the top (71% and 21% respectively) where these pump starters are being used. This indicates that farmers started perceiving the need for reducing the water usage and wished to look for the alternatives to make best use of available water. By dialing a code number from his mobile phone to a wireless device attached to the pump, farmers can now remotely monitor the electricity supply. This feature could be best harnessed for crops like paddy (Table 4).

Table 4: Crops Cultivated under Automated Pump-starters (n=111)

Crops under automated pump starters	Frequency	%
Paddy	79	71.17
Sugarcane	24	21.62
Banana	2	1.80
Chilli	2	1.80
Cotton	4	3.60
Maize	5	4.50
Malabar Neem	1	0.90
Mango	6	5.41
Turmeric	4	3.60

One of the variables determining the rate of adoption of an idea is the perceived attributes of innovation. The digital technologies may offer a variety of solutions to the farmers, but the adoption of such digital technologies in farmers fields are influenced by the perceived attributes rather than the absolute attributes. An attempt is made to understand the perceived attributes of auto pump starters in terms of direct benefits, indirect benefits and challenges faced by farmers while adopting this technology.

For all the farmers using auto pump starters, the perceived benefits included; relative easiness to operate/ irrigate compared to earlier, time saving, safety (Personal safety, Pump set safety) and the flexibility of irrigating (Table 5).

Accessibility of pump sets during the odd hours has always been challenging, particularly when they are located in difficult terrains. More than 74% of the farmers opined that remote accessibility of pump sets using the auto starters was a striking feature. Another advantage that was reported by 73% of farmers is this could be operated by any family member (unlike only family head has to go in conventional method).

Update about status of irrigation was perceived as an excellent option by 96.3% farmers. Ease in planning irrigation cycles was also seen as an added advantage by 94.5% of farmers. The ability of these pump starters to

bypass into manual mode option in case auto starter doesn't work was much appreciated by the users. Update about the status of water in a tank/ well without being physically there – was one of the best benefits of these pump starters (as perceived by 92.7 %).

Table 5: Relative advantages of Auto Pump starters as Perceived by the Farmers (n=111, multiple responses)

Direct benefits	Frequency	%
Easy to operate / irrigate compared to earlier	111	100
Time saving	111	100
Safety (Personal safety, Pump set safety)	111	100
Flexibility of irrigating	111	100
Remote Accessibility of pump sets (vehicle can't get there!)	83	74.7
Can be operated by any family member (unlike only family head has to go)	82	73.8
Gender / Literacy no barrier	104	93.6
Updates about status of irrigation	107	96.3
Ease in planning irrigation cycles	105	94.5
Bypass (Manual mode) option (in case auto starter doesn't work)	111	100
Update about the status of water in a tank/ well	103	92.7
After sales service support	88	79.2
Indirect benefits		
Reduced water wastage	111	100
Reduced electricity wastage	111	100
Reduced labour wastage	111	100
Reduced fuel wastage (POL)	108	97.3
Cost effectiveness	94	84.6
Adding to awareness about resource conservation	109	98.2
Local capacity – business opportunities	98	88.2
Daily / weekly reports – decision making	87	78.3
Increased crop productivity	67	60.3

There are other indirect benefits that were reported by the farmers such as reduced water wastage, electricity wastage, labour wastage and fuel wastage (POL). More than 78% of the farmers reported that auto starters have helped taking timely and effective decisions on irrigation based on the daily / weekly reports. The departments of agriculture and irrigation can develop few strategies based on the data collected from a large number of auto pump starters. This will have far reaching consequences on the release of water in canals or for timely personalised advisories on crop (water) management strategies to the farmers. There is a need to further quantify these benefits using secondary data at macro level.

Table 6: Challenges in large scale adoption of Auto Pump starters as Perceived by the Farmers (n=111, multiple responses)

Difficulties - Negatives	P	F
1. Costly	57.7	64
2. Skills not available to use	24.3	27
3. Skills not available to repair	48.6	54
4. Wiring damage	42.3	47
5. Theft	6.3	7
6. Not working properly	26.1	29
7. Over flooding	27.0	30
8. Poor control	5.4	6
9. Not useful	4.5	5
10. Perceived as excessive sophistication	33.3	37
11. More electricity is consumed	3.6	4
12. Useful only for commercial crops	0.9	1
13. Mobile net working issues (poor signals)	32.4	36

There are few challenges as perceived by the farmers in use of auto pump starters. Some of these challenges could be overcome by interventions by the concerned organizations or even with the group discussions with the other farmers.

About 27% of farmers opined that it required few skills that their family members were lacking in using smart phones for operating. One of the critical challenges faced by farmers was that in the villages there was no man power that could handle trouble shooting and immediately replacing the wiring, if they got damaged. Even 7% of the farmers believed that these sets might get stolen (Table 6).

There are few other challenges observed like excessive sophistication and higher electricity consumption. Increased awareness and long term usage of auto starters can prove this wrong. But there is a need to empirically quantify the benefits at individual farmer's level and at village level, so that effective extension strategies could be chalked out in future.

Conclusion

Several players are engaged in agriculture irrigation automation system that include auto-pump starters, GPRS based drip irrigation automation, IOT applications etc., It is now possible for a farmer to operate his pumpset to irrigate fields with a mobile phone. These smart irrigation solutions will help small farmers in a big way. Besides reducing water wastage, the GSM-based mobile starters were equipped with latest software technology. It will help curtail water

and energy wastage as it alerts the farmer in case of faults, overload etc, through a call. The improvement in irrigation efficiency will also lead to higher yield and productivity, in long term.

India has deployed a plethora of digital pilots in the field of agricultural development in last two decades. The Indian government, private industry, civil society organizations are developing and disseminating a series of innovative, networked solutions to increase availability, accessibility and applicability of agriculture services at farm level. In order to exploit the possibilities, digital service have to provide practical solutions that would reduce the cost of cultivation and would bring efficiency in field operations that would eventually increase their productivity and income.

Acknowledgments

This work was carried out as a part of the project "Maximizing the Impact of Rice Technologies through ICT applications" funded by ICAR- Indian Institute of Rice Research, Hyderabad. The support received from ICAR, IIRR, AICRIP co-operators is gratefully acknowledged.

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