Sugarcane Information System (SIS) developed by the UP State Sugarcane Department (India)

An Impact Assessment Study

Indian Institute of Sugarcane Research
Lucknow

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Foreword

The management of the sugarcane procurement system involves a complex web of interactions between the farmers, sugar mills and the sugarcane department. The Sugarcane Information System (SIS) is a very innovative project launched by the sugarcane department to make the system simple, transparent, user-friendly and more efficient leading to the overall development of the sugar sector of the state of Uttar Pradesh. The Indian Institute of Sugarcane Research (IISR), Lucknow, a Govt. of India funded premier research organization on sugarcane is mandated to review the innovations like SIS which has a direct impact on the quality & quantum of raw material supplied to sugar mills and analyze its replicablility elsewhere in the country.

The assessment of the Sugarcane Information System (SIS) has been independently carried out by a multi-disciplinary team from the Indian Institute of Sugarcane Research, Lucknow. The findings are based on the information gathered from the farmers, the farmers' representatives, the sugar mills and the sugarcane department officials. The relevant information was collected through field surveys, questionnaires, on-the-spot verifications, personal interviews, interactive meetings and presentations. The information about the SIS, as available at the website of the sugarcane department *www.upcane.org/sis/en/index.asp.* and the "User Guide" at *www.upcane.org/pdf/User_guide.pdf.* has also been consulted.

The study substantiates the findings of the sugarcane department in terms of savings to the farmers, financial benefits to sugar mills and increase in the efficiency of sugarcane department. Based on our survey and observations, we feel that the implementation of SIS will be a turning point in making cane supply arrangements efficient and beneficial to all the stakeholders.

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1. Executive Summary

The Sugarcane Commissioner of Uttar Pradesh developed India's largest rural information technology (IT) network, the Sugarcane Information System (SIS), to overcome the problems associated with the existing cane supply arrangements to sugar mills in the state. Uttar Pradesh, the largest cane growing state of India, accounts for 43% (about 2 million hectares) of the national cane acreage. The highlights of SIS as assessed by the Indian Institute of Sugarcane Research, Lucknow, UP (India) are as follows:

- ***Innovative use of ICT:*** The SIS, comprising of website of sugar mills, password protected webpage for all cane growers supported by mobile text messages (SMS[1]) and IVRS[2], has accomplished the gigantic task to make online around 150 million annual transactions/ interactions between 3.0 million sugarcane farmers, 125 sugar mills and 168 cane cooperative societies engaged in the marketing of sugarcane worth Rs. 1,50,000 million (US $ 3000 million) annually. The SIS provides valuable information about the interactions between the sugar mills and farmers instantly and accurately, which eliminates the numerous farmers drudgery-inducing visits to sugar mills, and ensures that the wastage of time and money in these visits are avoided. The efficiency of sugar mills and the functioning of the sugarcane department have improved significantly. Many layers of the administrative machinery detrimental to the growth of the sugar sector have been eliminated. There is a complete paradigm shift in efficiency, accuracy, timeliness and competence ushered in by this e-Governance project.
- ***Financial viability:*** The SIS has been implemented without any budgetary support from the Government. Its entire expenditure has been borne by the sugar mills which are the delivery centres. The annual financial savings (to the tune of Rs. 7,971 million (US $ 159.00 million) made by the sugar mills from the implementation of SIS are many times more than the cost of the project (around Rs. 125 million or US $ 2.5 million). The yearly monetary benefits to the farmers are around Rs. 8,465 million (US $ 169.3 million) without any cost involvement. Hence, the SIS is financially viable also.
- ***Social acceptability:*** The SIS, developed on the principles of partnerships and collaborations, has been functional for the last two years and won the farmers confidence and appreciation. The farm-factory relations have improved and the

[1]SMS - Short Messaging Service
[2]IVRS - Interactive Voice Response System

numbers of interaction-related complaints have reduced dramatically. It also led to the promotion of IT literacy amongst rural masses. The SIS has greatly improved the Department's interactions with the growers. As a result, the Sugarcane Department's overall image has emerged as a citizen-centric facilitator for the growth of the sugar sector in the state.

- The SIS is, therefore, sustainable as it is financially viable, technologically accessible, socially acceptable, and user-friendly, and can be replicated in other departments/ areas.

2. About Indian Institute of Sugarcane Research

The Indian Institute of Sugarcane Research (IISR) is a public-funded and internationally renowned sugar crops research organization under the Ministry of Agriculture, Govt of India. It was established by the Indian Council of Agricultural Research (ICAR), New Delhi for conducting researches on both fundamental and applied aspects of sugarcane culture as well as to coordinate the work done on this crop in different states of India. Since its inception, the Institute has been working towards the upliftment of cane agriculture in India and other sugar producing countries, in terms of quality, productivity, management practices and various policy issues.

The Institute has scientific cadre strength of 74 scientists representing various branches of agricultural research like Genetics & Plant Breeding, Biotechnology, Microbiology, Agronomy, Soil Science, Agricultural Entomology, Plant Pathology, Plant Physiology, Biochemistry, Agricultural Engineering, Process Engineering, Economics, Statistics, Computer Applications, Agricultural Extension, and Agrometerology. During the last 60 years of its establishment, the Institute has developed expertise in developing suitable sugarcane varieties, planting techniques, irrigation and fertilizer application methods and scheduling, intercropping techniques, disease and insect-pest surveillance and management, appropriate machines for plant and ratoon crop, post-harvest management, and value added products. The Institute has provided number of consultancies to sugar mills in developing sound cane development plans, contract services to test the efficacy of products developed by the private sector manufacturers, and advisory services to the Govt. of India/State Governments on various policy/price/socio-economic issues related to sugarcane agriculture. The Institute has also been a member to high level Expert Group constituted by the Govt of India in 2008 to make recommendations to restructure the sugar sector in India.

The Institute is located in Lucknow, the capital city of Uttar Pradesh, the largest cane growing state in sub-tropical region of India. Since the development of the IISR technologies and its verification, refinement takes place mostly under the climatic conditions of Uttar Pradesh, the Institute provides additional location advantage to the State of Uttar Pradesh.

3. Background information on Sugar Industry in Uttar Pradesh

It is well established that sugarcane is grown traditionally in Uttar Pradesh, and the sugar industry is the main industry in the state since last century[3]. It is only after 1951 that the sugar industry rapidly spread itself in tropical belt comprising Gujarat, Maharashtra, AP, TN, and Karnataka states, and two broad distinct agro-climatic conditions commonly referred to as sub-tropical and tropical regions[4] became synonymous with the main sugarcane growing areas in the country. These regions accounts for 56.8% and 43.2% of the country's cane acreage, respectively.

Uttar Pradesh is the main cane growing state in sub-tropical belt of the country. It allocates about 2 million ha area to cane cultivation in the famous Indo-Gangetic plains and accounts for 43% of the country's cane area[5] and about 39% of the country's sugarcane production. Within sub-tropical region, it constituted 76% of the cane area and 81% of the sugarcane production during the year 2010-11. The total cane crushed in sugar mills in UP was about 27% of the total cane crushed in India during 2010-11.

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[3]In the early part of the last Century, up to 1920s, there were only 18 sugar mills in-operation in India, out of which 10 were in North Bihar, 5 in Uttar Pradesh. Of the 5 factories located in U.P., 3 were located in one district of Gorakhpur. At the time of initiation of the planning era (during 1950-51) in the history of India (after the Independence of India in 1947), there were 138 sugar factories in India and the Indian sugar industry was mainly concentrated in the sub-tropical belt, which accounted for 108 (78%) out of a total of 138 sugar mills at that time. Most of the factories (68 sugar mills out of 108) were situated in Uttar Pradesh.

[4]The tropical belt of India, comprising the states of Maharashtra, Tamilnadu, Karnataka, Andhra Pradesh, Gujarat, Chhatisgarh, Orissa and Kerala, accounts for 43.2% of the total area under sugarcane cultivation in the country. The sub-tropical sugarcane region (comprising the states of UP, Bihar, Punjab, Haryana, Uttrakhand, Rajasthan, West Bengal, Jharkhand, Assam, and other North & North-eastern states) constitutes around 56.8 per cent of total cane area in the country.

[5]The cane cultivation in the UP state is less affected by climatic aberrations compared to that of other cane growing states of India. During the years of climatic aberrations/drought years, when the acreage under cane cultivation reduces in the country, the cane acreage in UP is less affected due to assured irrigation facilities, the share of UP state rises to 47% of all India cane area (as in the years of 2008-09 and 2009-2010).

Though, sugarcane is grown in almost each of the 70 districts of the state, the extent of its cultivation is very high in 44 districts where it is mainly grown for the sugar industry. Collectively, these 44 districts account for about 97% of the total sugarcane area of the State. Out of these 44 districts, as many as 5 districts grow sugarcane in more than 60% of their net sown area (NSA) and 18 districts in more than 20% of its NSA. Not only the number of cane growing districts having higher concentration of cane (>20% of NSA) increased over the years but the percentage of NSA allocated to cane has also increased in these districts. Out of these 44 districts, the area under sugarcane in some of the districts is even higher than that of the total area under sugarcane in individual states of Punjab, Haryana, Uttarakhand, Gujarat and Madhya Pradesh. Hence, it is obvious that cane is cultivated more intensively in Uttar Pradesh compared to any other state of the country.

There are 125 sugar mills in operation located in 38 districts and drawing sugarcane from these 44 major cane growing districts in the state. The sugar mills in the State are functioning under all the three sectors. Under the liberalization regime announced by the Govt of India in 1992, the sugar mills in private sector have grown tremendously in terms of modernization and increase in its crushing capacity upto 16,000 tonnes of cane per day (TCD[7]), compared to the sugar mills in other sectors. Consequently, the average cane crushing capacity per sugar mill in the state is much higher compared to any other state. The state crushed about 64 million tonnes of cane out of about 120 million tonnes of cane production in the state during 2010-11.

The sugarcane is produced by 3.0 million sugarcane farmers in the state. Each sugar mill has to coordinate the cane supply of about 24,000 farmers on an average (range 10-40 thousand farmers per sugar mill) and that too by giving due consideration to maturity and stage of the cane crop as well as social justice and equity issues in planning the cane harvesting schedule. These sugar mills purchase sugarcane through 168 Cooperative Societies, and pay around ₹ 1,50,000 million (US $ 30,00 million) annually to farmers as cane price (1 US $ equivalent to ₹ 50).

[6]Sugar mills were mostly in private sector in UP at the time of Independence, and even by the end of First Five Year Plan (1955-56). Keeping in view the interests of fast increasing sugar industry and cane production in the country, the co operative sector was strengthened after the initiation of Five Year Plan. It was in 1958-59 that the first sugar mill in cooperative sector was established in UP, and after that there was a tremendous growth in the number of sugar mills in the cooperative sector.

[7]TCD - Tonnes of cane per day. This refers to the size of the crushing capacity of the sugar mills.

4. Problem Statement

Sugarcane is a perishable raw material for sugar industry and it must be processed at the earliest after harvesting in order to minimize losses in cane tonnage and sugar recovery. The quality of cane produced and supplied to sugar mills is of paramount importance and its logistics need to be organized on scientific lines. This involves multiple services such as survey of cane area, calendar of supply, monitoring of sugar mills/centre, issue of supply tickets, weighing of harvested cane, payment and various other activities related to sugarcane development. The number of cane growers supplying cane to a factory ranges between 10 to 40 thousand in Uttar Pradesh, and the farmers need authentic, accurate and timely information/services for smooth marketing of their produce at best possible prices and without any hindrance. Consequently, the interactions for activities between the farmers and the sugar mills are numerous and spread out over the year and have a direct bearing on the income of both. All the players in the existing system of cane supply arrangements to sugar mills: farmers, sugar mills, cane societies and the Sate Government suffer in one way or the other. The specific problems to each category under the system were as follows:

Farmers: The parameters of interactions related to farmers include, area under sugarcane, number of supply tickets, weight of sugarcane supplied, payment made *etc.* Each cane grower had to make about 53 trips to sugar mills per annum (Table 1) to organize his cane supply and receive price payments.

Table 1. Sugar mill - Farmer Interactions in UP per annum

S. No.	Activity	Interactions (Approx No.)
1	Survey of fields	2
2	Calendar of supply	1
3	Start of sugar mills/centres	2
4	Supply Tickets	12
5	Weighing of sugarcane	12
6	Payment of sugarcane	12
7	Development & other activities	12
	Total interactions	53

Considering 3 million number of cane growers, it all leads to over 150 millions interactions per annum. Numbers of problems are associated with these interactions, and have economic implications. These problems include i) absence of data sharing/ lack of transparency in the farmer - sugar mill interactions leading to resentment, corruption and presence of middlemen, ii) wasteful expenditure on travel, iii) lower

income due to smaller supply of cane and smaller allocation of area under cane, and ii) reduced weight due to staleness in cane.

Sugar Mills: Sugar mills also suffer on three counts: i) loss of income to sugar mills due to arrival of stale sugarcane, and ii) the lower utilization of sugar mill installed capacity, and iii) manual data entry at cane purchase centres. The fresh sugarcane has a high sugar content which quickly reduces with time. An increase of 12 hours in supply time would reduce sugar recovery by 0.10% leading to an additional loss of ₹ 1932.0 millions for the sugar mills. All the 125 sugar mills have an installed capacity to crush sugarcane for 180 days in a year whereas cane availability is sufficient for only 120 days. The farmer diverts his sugarcane to jaggery producers at lower prices.

Thus, the existing system of cane supply to sugar mills was non-transparent, time consuming, full of errors & corrupt practices and number of complaints received sometimes exceeded 6.0 million/year. The manual helpdesks were inefficient and inadequate to meet the need of farmers. Thus, the sugar mills and the farmers were both losing money.

Sugarcane unions/cane marketing societies: The success of sugarcane unions in UP has taken place with a legislative framework in 1954 by way of Sugarcane Purchase Order 1954 which empowers the State Govt: (a) to notify a particular cane growing area as a reserved for, or as assigned to a particular factory (b) to allow sales only through co-operative societies, and (c) to prescribe the manner in which non-members can sell through the canegrowers co-operative societies. Consequently, cooperative societies and cane development councils/unions (168 in number) were made in sugar mill cane command area. These unions supply 100% of the sugarcane crushed by sugar mills in the state. With the growth of private sector sugar mills under liberalization regime in the state, though, the role of cane unions in coordinating the sugarcane supply to the mills has dwindled, and the sugar factories have computerized the operations which were once done by the societies. These societies are now providing loan facilities to member farmers and have to interact more frequently with the growers. These societies have to recover the loans given to the cane growers out of the cane price payments by sugar mills.

Cane Department: The cane department has to establish a better liasion with 3 million cane growers, 168 cooperative societies, and 125 sugar mills, the main players with diverse and often conflicting interests. The number of cane farmers, sugar mills

and the cooperative societies in the state are very large, and it is very difficult to serve them better to their satisfaction in a limited crushing period without the aid of any effective tool. The department was also desperate to improve its functional efficiency despite all odds. The farmers are remotely located (villages are far from offices/mills), there is delay in providing the service (information of survey, supply ticket *etc.,* gets delayed due to manual distribution). Most of the vital information is also lost (survey, supply ticket *etc.,* not reaching the grower), or gets destroyed due to rivalry (vested interests destroy supply tickets *etc.,*) There is also suppression of information due to some corrupt elements associated with the system. In the absence of effective communication medium/tool, the department was constrained to provide the cane growers an efficient delivery of services in time. The department was, thus, in the search for a system which may transform the way in which it may interact with the growers and millers, with more accuracy, speed and in a more transparent manner.

5. Solution of the problem

In order to overcome the problems faced by the cane growers in cane marketing and better streamline the interactions between them, there was a need for a robust, easy to operate and cost effective system. Besides, each sugar mill had to be totally convinced about the utility of the new system as it is the sugar mill that had to be an independent delivery centre for it to be a successful system on a sustained basis. The cane supplies to sugar mills are regulated by virtue of the statutory powers vested in the Cane Commissioner, hence the farmers and the sugar mill interactions in this regard are also regulated by the Cane Commissioner vide statutory powers in terms of The UP Sugarcane Purchase and Regulation Act. By virtue of these powers, the UP Sugarcane Department developed a new system, the Sugarcane Information System (SIS) during the year 2010-11, an example of unique collaboration between the UP State Government, the 125 sugar mills and 168 sugarcane cooperative marketing societies. SIS is an outcome of the vision and initiative of the Cane Commissioner followed by meetings with IT experts, farmers' representatives and the sugar mills, in the form of stakeholders' meets, during August and September 2010.

The chronology of SIS development is given in Table 2. The development of the whole SIS has been carried out at a greater speed and the implementation has been assured in a record time of 12 months keeping in view the large and diverse dimensions of cane cultivation in UP state. Inputs regarding the use of technology most appropriate

to the rural countryside were obtained from the farmers' representatives. The responsibility of implementing the system rested with the sugar mills. The SIS was launched in November 2010. After the launch, monthly review meetings were held to monitor the progress. Many changes have been incorporated which have made the SIS more friendly towards the rural farmers. The use of Hindi language in SIS has been an important change.

Table 2. Chronology of the development and implementation of SIS in UP

Time period	Events	Details
Aug.-Sep, 2010	Stakeholders Meet	Independent IT experts were called upon to contribute with their expertise. An effective, instantaneous and reliable communication system that could share complete information between the 3.0 million growers and 125 sugar mills was considered the solution. A three tier system involving the use of website, SMS & Query SMS system, and the IVRS which may ensure that all the farmers with varying literacy levels could equally benefit from the system, was considered. Further, each of the 125 sugar mills was considered to be independent delivery centres.
Sep.-2010	Design of model website	Model website for a sugar mill was launched by the sugarcane commissioner in September, 2010. It contained the basic templates for database to ensure uniformity across the whole state.
Sep-Oct. 2010	Collection of mobile telephone numbers	Each of the 3.0 million farmers was contacted individually to collect the mobile telephone numbers.
Nov.-2010	Launch of website by sugar mills	The IT personnel of each sugar factory were trained. Thereafter, each sugar mill created the database of its growers and displayed it on their website. Due to standardization, each of the 125 sugar mills website were identical and the 3.0 million sugar growers had their individual webpage which provided comprehensive information.
	Launch of IVRS	Uniform protocol for IVRS was designed by the office of Sugarcane Commissioner. Each of 125 sugar mills provided the grower information *via* IVRS through toll free lines.
	Launch of SMS and Query SMS System	Each interaction of the farmers with the sugar mill was to be followed up by a confirmatory SMS. Growers started getting the SMS from November 2010. Till date, 100 million SMS have been sent.
	Service level Agreements (SLA)	To ensure that each of the 125 sugar mills provides uniform, reliable and high quality services, the use of SLA's was made mandatory. The model SLA was adopted by the sugar mills.
Nov. 2010 to Mar. 2011	Training of Growers	The sugar mills as well as the cooperative grower's societies trained the farmers. Leaflets were distributed widely to educate the farmers in the use of SIS.
Nov. 2010 to Oct. 2011	Hand Held Computers (HHC)	This was used to provide printed receipt to the grower during instead of a hand written one. Each of the 7000 purchase centres got the HHC during this period.
	Review meetings	Since the launch of SIS in November 2010, monthly review meetings were held to monitor the progress. Many changes have been incorporated which have made the SIS more friendly towards the rural farmers. The use of Hindi language in SIS has been an important change.
The overall planning, development, implementation and the functioning of SIS has taken place under the supervision and guidance of Shri Kamran Rizvi - UP Sugarcane Commissioner, Shri Amitabh Prakash- Additional Sugarcane Commissioner, Shri Rajesh Pandey - Joint Sugarcane Commissioner, Shri Anil Kumar Sharma - Chief Engineer and Dr. Kripal Singh-Deputy Sugarcane Commissioner.		

Abbr: QSMS - Query Short Messaging System; HHC - Hand Held Computor

Source: Office of the UP Cane Commissioner

The Sugarcane Information System (SIS) enables an effective utilization of Information and Communication Technologies (ICT) for efficient marketing of sugarcane to mills and also extension of production/protection technologies to farmers. SIS utilizes state of art technologies *viz.*, website, SMS, QSMS, IVRS and HHC for an effective management of information in sugarcane marketing to mills. Each of the 125 sugar mills in operation in the state has been made as an independent delivery centre for information. The three main sub-systems of SIS are described in detail in Fig.1 and Table 3.

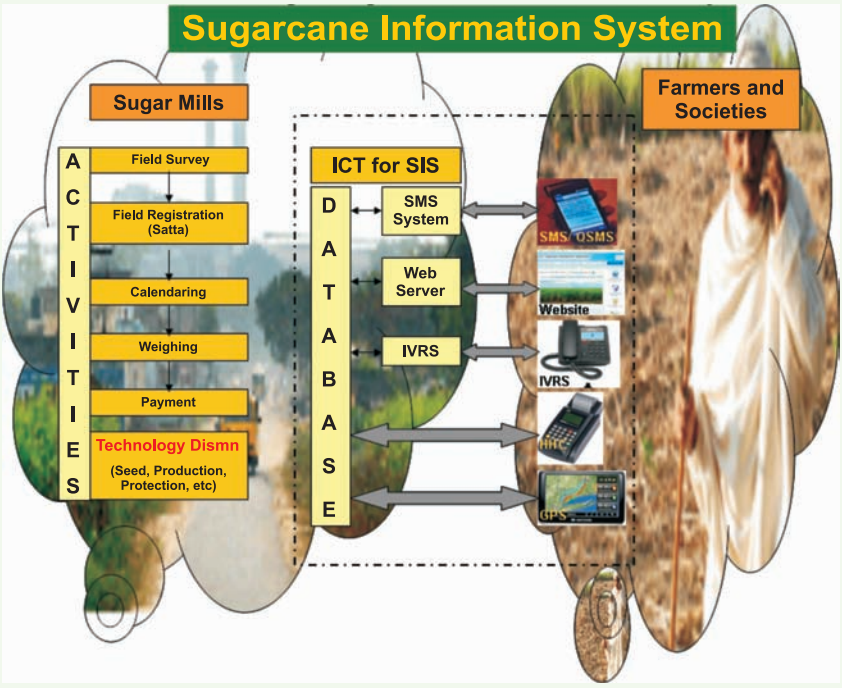


Fig 1: Sub-systems of Sugarcane Information System

SIS provides free and efficient services available round the clock which includes cane area, bonding, requisition, purchase, payment to each of over 3.0 million cane growers in the state. Websites at every sugar mill, the SMS and QSMS system, and the Interactive Voice Response System (IVRS) in SIS are the desired medium options to provide the requisite information to the growers, and other stakeholders. This is a very good opportunity to the sugar mills for interacting with the farmers in a very effective way, and also in developing healthy farm-factory relationship which is a must condition for the sustainable growth of the sugar industry. The implementation of model website of SIS at 116 sugar mills and the use of Hand Held Computers (HHC) in

Table 3. Sub-systems of SIS

(1) **Websites :** The website is the most comprehensive method of communicating with users and the data on website is the platform for SMS, IVRS and HHC systems. To ensure that all the 125 sugar mills in UP state of India had website with identical features, the Sugarcane Department launched the model website for sugar mills. It was hosted on the project website www.upcane.org/sis for the guidance of sugar mills that incorporated all the features. Each of the 3.0 million sugarcane growers has a personalized password protected webpage containing latest up-to-minute information regarding their interactions.

(2) **SMS system :** All the 3.0 million sugarcane farmers have been contacted individually and their mobile number was collected. The SIS sent around 100 million SMS to all the farmers which cover each interaction with the sugar mills. This system has also been implemented by all the 125 sugar mills.

(3) **IVRS :** The IVRS system is most suitable for illiterate people since it reads out the instructions as well as the desired information. The farmer can get the personalized information regarding cane survey, issuance of supply tickets, calendar, weight of sugarcane supplied and cane price payment. In all, 125 sugar mills are running this system successfully.

(4) **Hand Held Computer (HHC) :** This is a rugged and a cost effective device equipped with a printer and GPRS capability. The farmers used to get hand written receipts against cane supplied at the purchase centres. The weighing clerk often made mistakes, lost the sugar mill copy of the receipt or tampered with it. As a result, farmer was the victim and the sugar mill lost goodwill of the farmers. With the use of HHC, the purchase centres of sugar mills have been connected with main computer system of sugar mill *via* GPRS connections and the sugarcane farmers get printed weight slips.

Source: ***Sugarcane Information System (A user guide)*** *available at the www.upcane.org/pdf/User_guide.pdf. The English version of SIS website is at www.upcane.org/sis/en/index.asp.*

all 7000 purchase centres is a welcome step towards efficient cane management and its marketing in the state. The progress is monitored/reviewed by special audit software which process information directly from the database servers of sugar mills. The decentralization of delivery platform solves the problem by dividing it into manageable smaller problems. The SIS is, thus, the largest rural IT network in India which connects the 3.0 million sugarcane growers with the 125 sugar mills spread out in 44 districts. The SIS has an inbuilt mechanism to provide information to the farmers at their doorsteps which otherwise the farmer gets by frequent visit to sugar mill, society office and bank. The time spent in these activities will be spared for other productive work.

The SIS aims at delivering enhanced value to its beneficiaries through effective use of ICT. It, thus becomes necessary to examine i) the impact of outstanding service delivery on beneficiaries and agency, ii) the standard of provided services, iii) the perceptions of service users (citizens or businesses) in terms of service delivery quality as outstanding iv) the extent to which it is 'citizen-centric', in terms of relevance of services provided, effort and time invested by the user, and user convenience in making use of the service, and v) the uniqueness of the service compared to other common services provided by other government departments/agencies.

The assessment by IISR Lucknow is an effort to provide answers to the above mentioned questions.

6. SIS Study Team

A multi-disciplinary team of scientists from the Indian Institute of Sugarcane Research, Lucknow under the leadership of Dr. S. Solomon, the Director of the Institute and a well known scientist in the field of sugarcane post-harvest management, reviewed the functioning of the Sugarcane Information System (developed by the UP Cane Department) at sugar mill level and its impact on cane growers. The other members of the team from IISR were as follows:

1. Dr. A. Chandra, Principal Scientist & Head of Division, Plant Physiology and Biochemistry
2. Dr. T.K. Srivastava, Principal Scientist & Head of Division, Crop Production
3. Dr. A.K. Sharma, Principal Scientist, Agricultural Economics
4. Dr. S. N. Sushil, Senior Scientist, Agriculture Entomology
5. Dr. A.K. Sah, Senior Scientist, Agriculture Extension
6. Dr. S.S. Hasan, Scientist, Computer Applications

7. Presentation of SIS before the team

UP Cane Department under the overall coordination of Sri Kamran Rizvi, the Sugarcane Commissioner of UP held an interactive meeting at the Indian Institute of Sugarcane Research, Lucknow and presented the highlights of SIS. During the interactions, it was suggested that the impact of SIS should also be assessed more intensively from the farmers perspective in a few sugar mills of the state. The need for a rapid appraisal of the impact of SIS at the farmers fields was also felt.

Mr. Rajesh Pandey, Joint Cane Commissioner, UP Cane Department along with Sri Anil Kumar Sharma, Chief Engineer and other district level cane officers coordinated the rapid appraisal of the SIS in the cane command areas of 10 sugar mills. The operation and functioning of the components of SIS were presented before the team and some aspects were also field-tested/reviewed on-spot on sample basis. The entire presentation of SIS components and interactions on its impact was also made before the gathering of over 150 farmers and their representatives at the Saksaria Sugar Mill at Biswan in Sitapur District of Uttar Pradesh. The General Manager and the Deputy General Manager of Saksaria Sugar Mill, Biswan and the cane management staff of 10 nearby sugar mills were also present in the rapid appraisal and during interactive meetings.

8. Methodology used for assessment

The assessment is based on primary as well as secondary information compiled from 10 randomly selected sugar mills in Uttar Pradesh. The selected sugar mills from where the information was compiled are Saksaria, Oudh, Dalmia (Ramgarh), Dalmia (Jawaharpur), BCM (Haidergarh), BCM (Rozagoan), DCM (Daurala), Bajaj (Kumbhi) Bajaj (Babhnan) and Bajaj (Balrampur). The crushing capacity size-wise details of these sugar mills are given in Table 4.

Table 4. Crushing Capacity Size-wise Distribution of Selected Sugar Mills

Sugar Mill Group (TCD)	No. of Sugar Mills					Methods used
	Total	Sugar units only	Sugar + Cogen units	Sugar + cogen+ ethanol units	Region	
Up to 5,000	1	-	1		Central-1	Visit, rapid appraisal, on-the spot verification and interactive meeting. Information on desired parameters obtained through Cane Department
5,000-10,000	8	2	3	3	Western-1 Central-4 Eastern-3	
10,000	1	-	-	1	Eastern-1	

A rapid appraisal of the system/facilities developed under SIS was also carried out in Saksaria Sugar Mill Command Area in Central U.P. (the representative region of UP state as it combines the features of both Eastern and Western UP regions) by a multi-disciplinary team of scientists from IISR, Lucknow for ground level and on-the spot verification. To gather information from the cane growers, an interactive meeting, with cane growers/society representatives of 7 cooperative societies, was carried out in the cane command area of the Saksaria Sugar Mill. The perceived benefits of SIS by 52 farmers were assessed by interacting with the farmers in a group meeting (24 farmers), individually (10 farmers) as well as telephonically (18 farmers) during February, 2012. The sugar mill-wise distribution of farmers selected is presented in Table 5.

Table 5. Distribution of selected cane growers, sugar mill -wise, Central UP

No.	Sugar mill represented	Capacity (TCD)	Cane societies represented	No. of Farmers Interviewed in			Total
				Group meeting	Personal Contact	Telephonic Conversation	
1	Avadh (Hargaon)	10000	1	5	2	4	11
2	Dalmia (Ramgarh)	7500	2	7	3	5	15
3	Dalmia (Jawaharpur)	7500	2	7	3	5	15
4	Saksaria (Biswan)	7500	1	4	2	2	8
5	BCM (Haidergarh)	5000	1	1	-	2	3
Total				24	10	18	52

Abbr. TCD refers to the crushing capacity of sugar mills in terms of " tonnes of cane crushed per day"

Simple tabular analysis was carried out to present the information into suitable categories wherever required.

9. How was data collected?

The impact assessment of SIS on farmers; welfare and the benefits as perceived by them was carried out based on the primary data compiled from the farmers during the rapid appraisal, individually as well as in interactive meeting. The impact on the sugar mills and the cane department was based on the published as well as unpublished information made available by them. The brief description about data collection in the study, from different stakeholders of SIS, is as follows:

From farmers: The team tried to assess the benefits of SIS as perceived by the farmers by interacting in a group as well as individually. The team also carried out on-the-spot verification of the ease developed by the system. In order to have a neutral view on the impact of SIS, the team also interacted with other cane growers through telephonically after the rapid appraisal visit was over. The information on the perceived benefits by the cane growers was compiled in a questionnaire. The concerns raised by the farmers/farmers representatives during interactive discussions were also recorded.

The information from cane cooperative societies was also compiled by personally interviewing their representatives/office bearers.

From factories: The information pertaining to the sugar mills was compiled from the raw information provided by the sugar mills. The good offices of the Cane Commissioner were used to get the quantitative information from the selected sugar mills. The sugar mill representatives (General Managers/Deputy General Managers) of a few sugar mills were also interviewed personally. An interactive meeting was also held with them and the desired information was compiled in a questionnaire. The presentations from a few sugar mills on the functioning of SIS were also assessed to see the efficacy of the functioning of SIS. Informal discussions/telephonic conversations were also held with some sugar mill officials. Hence, the published as well unpublished information pertaining to the sugar mills was compiled and used in the analysis.

The team also reviewed the operation of the website of the sugar mill and its interface with the cane growers. The provision of receiving complaints in the website from the farmers and the system developed for the rectification of the problems is also user friendly. The farmer can be contacted at any time by any official of the sugar mill or of the cane department. At the same time, the farmer can also contact any official of the cane department for any query or for the rectification of the problem. All the features of SIS were reviewed and found to the satisfaction of the team. The team also visited cane-purchase centres of the mill and reviewed the functioning of the Hand Held Computer in fast processing the information for making cane price payment to the farmers in time. It was also found to be a good intervention and a vital component of SIS.

From Cane Department: The operation and maintenance of SIS by the cane department was explained to the team by the UP Cane Commissioner and the Joint Cane Commissioner in separate rounds of meetings. The department also carried out presentation of SIS at IISR, Lucknow and held interactive meetings with sugarcane scientists. All published and unpublished information on the performance of the SIS was obtained from the cane department. The information pertaining to the operation of SIS at sugar mill level was also compiled from the cane department. As per requirement of the citizen charter, the phone numbers of all the cane development officers are given in the website to facilitate any query from the cane growers. The provisions of IVRS were also tested and verified.

10. Impact of SIS

The revolutionary impact of SIS has been worked out on three fronts, *viz.*, i) the increase in income of the sugarcane farmers, ii) monetary and other benefits to sugar mills, and iii) efficiency of the Cane Department. The impact has also been assessed on sustainability parameters like transparency, coverage, increase in efficiency, financial viability, cost to the Government, replicability, and the work culture towards the use of IT in rural areas.

Based on the information gathered from the sugar mills and the farmers pertaining to one year (year 2010-11 over 2009-10), the values of the basic performance indicators required for the overall assessment of the SIS were worked out (Table 6). These are as follows:

Table 6. Value of performance indicators due to SIS

Sl. No.	Performance Indicators	Value
1	Increase in cane supply to sugar mills	20% of the additional cane supplied
2	Increase in cane area	25% of the total cane area increased
3	Increase in cane productivity	25% of the increase in cane productivity
4	Reduction in interval from harvest to supply to purchase centres	24 hrs
5	Higher weight due to fresh cane supplied by farmers	4% of the weight of the additional sugarcane supplied
6	Gain in sugar recovery due to less staling at farmers' end	0.2%
7	Farmers visits to sugar mill/society	24 visits reduced to 4 visits
8	Average reduction in time from purchase centre to sugar mill	4 hrs
9	Gain in sugar recovery from centre to sugar mill	0.03%
10	Reduction of labour requirement on account of automation due to HHC at each sugar mill	10 persons

Presentations about individual sugar mill websites reveals that all the farmers with mobiles in selected sugar mills were covered in sugar mill website. These were containing comprehensive data regarding crop area, bonding, cane requisition, purchase, and payment for each cane grower. The data displayed on the website was accurate. The sensitive information pertaining to the farmer is password protected. A mechanism for redressing the complaints has also been provided in the website. The hit counts are also being recorded and during this year, the number has reached to 1.5 million independent hits. The information on SMS and Query SMS is delivered in local language (*Hindi*). The QMS protocol is uniform to all the sugar mills. About 5% farmers

who were not having mobiles were also covered through the mobile of the neighbour/other family member.

All the farmer-sugar mill interactions (over 150 million per annum) can be assessed *via* three sub- systems *viz.,* Websites, SMS and Query SMS system and IVRS. The three sub systems ensure that the farmers across the literacy spectrum benefit equally from SIS.

10.1 Impact on farmers

The SIS has impacted the lives of the sugarcane growers on many fronts. There are direct as well as indirect benefits to the growers. The direct monetary benefits are accruing from the additional quantity of sugarcane available for sale, higher weight of cane supplied due to fresh sugarcane, increase in area under sugarcane, increase in cane productivity due to timely availability of better technical information on the website and mobile phone. The indirect benefits include the saving in travel cost and time. Based on the information from the rapid appraisal in Central Uttar Pradesh, it is evident that the farmers of different size classes were unanimous about the beneficial impact of SIS in terms of the delivery of vital cane marketing related information, particularly pertaining to the time and quantity of the cane to be crushed.

i) Saving in travel cost: The farmers were well assured that with the introduction of this facility, the drudgery associated with the manual system of cane marketing has decreased considerably. Before the implementation of SIS, every farmer had to travel 25-30 kms of distance to the nearest sugar mill/society office, 20 times a year on an average, to get information related to the marketing and payment of his cane supply. After getting the information, he had to make arrangements for harvesting and transport of the cane, and in this way, the execution of the event also got further delayed. Each trip at the cost of ₹ 200 (US $ 4.0) translates to a huge cost in terms of time and money of the farmer during peak cropping season. Considering 3.0 million cane farmers in the state, it would amount to expenditure in billions annually as travel and time cost to get the information. After the implementation of SIS, the information is at the doorstep of every farmer. There is 75% reduction in the numbers of visits to society/sugar mill offices. The expenditure reduction and/or income enhancement due to saving in travel cost was estimated at ₹ 5220 million (US $ 104.4 million) annually as is evident from Table 7 in which other items of additional income/ expenditure reduction under direct and indirect benefits to the farmers are also given.

ii) The farmers also benefitted by way of increased supply of sugarcane to the sugar mill. The additional cane supply per sugar mill during the year when SIS was implemented was 6.14 thousand tonnes amounting to 7.67 million tonnes at the state level. The interactions with the sugar mills attributed 20% of this increase in cane supply due to SIS. This additional quantity, earlier, had to be routed towards the jaggery/*khandsari* making units on account of problems like non-availability of supply tickets. However, since the implementation of SIS, owing to the timely and accurate information about the cane supply, the farmers reverted back towards sugar mills which were paying higher cane price (by ₹ 40 per quintal) than that offered by the jaggery units. The income on account of additional cane supply was worked out to be ₹ 459.90 million (US $ 9.20 million) annually.

iii) Convinced with the ease in cane supply to the sugar mills, the farmers also got benefitted by allocating more area under sugarcane as the crop is profitable by ₹ 6,000 (US $ 120) per hectare on an average compared to rice-wheat cropping system followed in the area. Based on the data compiled from the farmers, the average increase in cane area per farmer was 0.077 hectare, aggregating to 2.32 lakh hectare additional cane area. The farmers attributed 25-60% of this increase to SIS. On a conservative estimate, 25% of the increase in cane area was considered in assessment, and the income due to this factor was assessed at ₹ 348.00 million (US $ 6.96 million) annually.

iv) Similarly, an increase in the cane productivity was also reported by the growers as the accurate information about the best agricultural practices and input use is being sent to growers in time through SMS. As per farmers' view point, considering 25% of this enhancement in cane productivity due to SIS, the increase in income of farmers was estimated at about ₹ 891.40 million (US $ 17.8 million) annually.

v) The major contribution to farmers' economy under SIS is in terms of higher weight of their cane due to fresh sugarcane supply. Being a perishable commodity, cane stalks starts losing both its sugar content as well as the weight. Before SIS, the farmers used to harvest the crop in advance by 60 hours before the anticipated time of arrival of the supply ticket. This led to decline in the weight of the sugarcane supplied. As per information available in literature[8],

[8]S. S. Malik and S.S. Grewal, Simbhaoli Sugar Mills

there is decline in weight of cane by 4% if the time interval from harvest to cane supply is increased from 24 hours to 60 hours. The use of the SIS gives the farmer the exact information well in time to harvest the crop. On an average, the supply time has come down by 24 hours due to SIS. The increase in cane supply is about 4% of the weight of the sugarcane supplied. Based on these considerations, the additional income due to timely supply has been worked out at ₹1546.62 million (US $ 30.94 million) annually.

Cumulatively, the savings to farmers due to 5 factors associated with the implementation of SIS are to the tune of ₹ 8465.4 million (US$ 169.3 million) annually. This has resulted in enhanced goodwill for the sugar mill and the department and is clearly visible at the social audits also.

Table 7. Impact of SIS on income of farmers

S. No.	Item	Unit	Before SIS	After SIS	Impact indicator	Annual Increase in income (₹/ US $ in million)
1	Saving in travel cost due to reduced number of trips to sugar mills/society offices per year	Nos.	20	4	16	5220.00
2	Additional income due to reduced time interval between harvest and cane supply resulting in higher weight of cane supply due to fresh cane supplied	hours	60	24	24 (Minimum)	1546.2 (US $ 30.94)
3	Additional income due to higher cane production supplied to sugar mill *vis-à-vis* jaggery units	million ha	56.76	64.43	7.67	459.8 (US $ 9.20)
4	Additional income due to increase in area under sugarcane	million ha	1.79	2.02 (av of 2 yrs)	0.23	348.0 (US $ 6.96)
5	Additional income due to increase in productivity	t/ha	56.34	57.00	0.66	891.0 (US $ 17.80)
	Total	-	-	-		8465.40 (US $ 169.30)

It was also ascertained whether the impact of SIS on farmers is scale neutral or biased. It was observed that SIS is scale neutral (Table 8) and the benefits are accruing uniformly to all the categories of farmers. All the categories of farmers were unanimous about the beneficial impact of SIS in terms of the delivery of vital cane marketing related information such as time and quantity of the cane to be crushed. The farmers are well

assured that with the introduction of this facility, time interval from cutting of sugarcane to its crushing has decreased considerably. The benefits are perceptible in survey of cane area, production, supply ticket and the price payments and they are uniform to small & marginal farmers to large cane growers.

Table 8. Benefits of SIS as perceived by farmers, category wise (% response)

Category	Avg. farm size (acre)	No. of farmers contacted	Per cent Response in Perceived benefits				Saving in time at purchase centre
			Survey	Production	Supply ticket	Price payment	
Small & Marginal	3.6	14	100	100	100	100	100
Medium	8.53	23	100	100	100	100	100
Large	15.2	15	100	100	100	100	100

Since the benefits to the farmers are substantial, the SIS developed on the principles of partnerships and collaborations, has won the farmers' confidence and appreciation. As a result, it has been functional for the last two years. The farm-factory relations have improved and the number of interaction-related complaints has reduced considerably. IT literacy has got promoted amongst rural masses across diverse literacy spectrum. The SIS is, thus, socially acceptable to the farmers.

10.2 Impact on sugar mills

The use of SIS has led to a better relationship with the sugarcane growers which is a very necessary condition for the overall growth of the sugar sector in the state. The significant direct benefits to the sugar mills are on the following four fronts as indicated in Table 9 *viz.*,

i) ***Supply of fresh sugarcane from harvest to arrival at purchase centres:*** The use of SMS in place of supply ticket has led to reduction in supply time between harvest and the arrival at the purchase centres. This in turn has ensured the arrival of the fresh cane resulting in higher sugar recovery. The time interval from harvest to supply at the centre has been reduced by about 24 hours or more. Considering 0.20% gain in recovery due to reduction in time interval by 24 hours (as per published and sugar mill sources[9]), the gain in income due to additional sugar produced would be ₹1930.5 (US $38.61 million) annually.

ii) ***Supply of fresh sugarcane from the purchase centre to sugar mills:*** The use of HHC has made the recording of weighing information at the purchase centre in an online manner. This has helped the sugar mills in better planning of cane

[9]S. S. Malik and S.S. Grewal, Simbhaoli Sugar Mills

loading/unloading as well as the cane transport. This also ensured the freshness of cane meant for crushing resulting in higher sugar recovery. The reduction in the duration of 4 hours and the gain in sugar recovery of 0.03% were estimated based on the data supplied by the sugar mills. The additional income under this head was worked out at ₹ 579.40 millions (US $ 11.59 million) annually.

iii) ***Reduction in mill data entry:*** The SIS has replaced 12 data entry operators per factory on an average. The use of HHC at remote purchase centres ensures that the data of cane purchase is directly available to the factory servers. The cost saving due to this facility was worked out at ₹ 208.80 millions (US $ 4.18 million) annually.

iv) ***Increase of sugarcane supply:*** With the use of SMS for sending information in time, the proportion of indent failures has reduced considerably and the farmers are delivering the cane at the stipulated time. By considering 25% of the additional cane crushed in sugar mills due to SIS, the additional income due to higher sugar production and higher sugar recovery was estimated to the tune of ₹ 5253.00 million (US $ 105.06 million) annually.

Table 9. Assessment of yearly income to sugar mills

S. No.	Item	Unit*	Before SIS	After SIS	Annual increase in income ₹ million (US $ in million)
1	Time interval between harvesting and supply to purchase centres resulting in higher sugar recovery	hours	60	24 (min.)	1930.5 (US $ 38.61)
2	Time interval between arrival of sugarcane at purchase centre and supply to the factory resulting in higher sugar recovery	hours	18	14	579.40 (US$ 11.59)
3	Cost of data entry of grower wise sugarcane purchase details	Entries million	41.80	Zero	208.80 (US$ 4.18)
4	Increase in sugarcane supply to all the sugar mills	million tonnes	56.76	64.43	5253.00 (US$ 105.06)
5	Total				**7971.70 (US$ 159.43)**

*Unit pertains to 4th and 5th Column

Hence, on account of higher recovery from fresh sugarcane, greater capacity utilization and savings in data entry due to use of HHC, the SIS is an effective tool to ensure the financial benefits to the sugar mills to the tune of ₹ 7970 million (US $ 159.4 million annually) as given in Table 9. The cost of implementation of the SIS software and hardware at the rate of ₹ 1.0 million per sugar mill has been estimated at ₹ 125 million (US $ 2.5 million) which is very less considering the financial gains the sugar mills are benefitting from. The SIS is, therefore, financially viable.

10.3 Impact on Cane Department

The Sugarcane Department enables the farmers to market their sugarcane at best possible prices without any hurdles, by providing number of services. These services are envisaged by statutory enactments and are of critical importance to the working of the department. These are as follows:

(1) Complete grower's information details including, name, village, bank account numbers, basic quota and mobile number *etc.*

(2) Complete cane area survey details including plot-wise, variety-wise cane survey.

(3) Detailed information about cane supply calendar (including fortnight supply ticket distribution), early and general variety of ratoon, and plant cane.

(4) Detailed information about date-wise issuance of supply tickets and the weight of sugarcane supplied.

(5) Detailed information about the date-wise cane price payment.

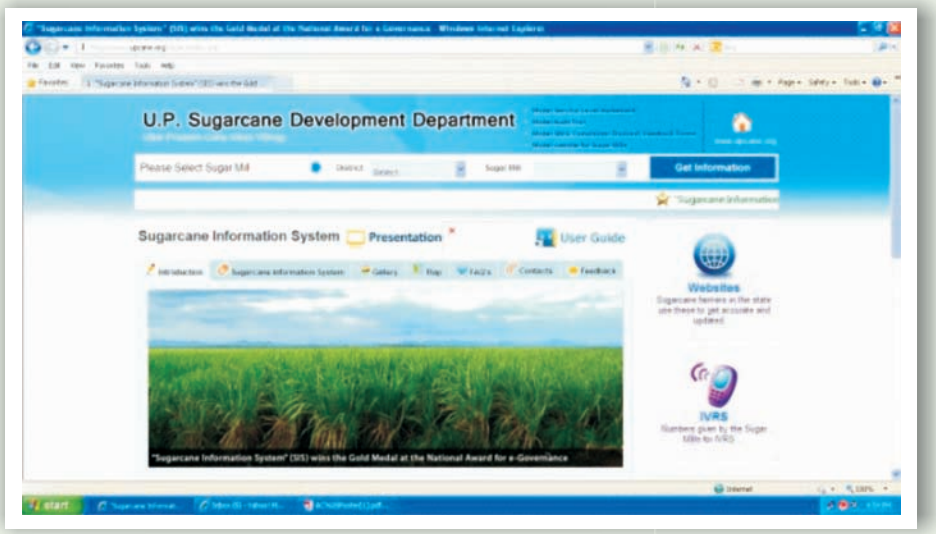
(6) Complete information about SMS sent to individual farmers to be seen on SMS log.

(7) Detailed information regarding use of IVRS, QSMS, HHC and Website.

(8) Detailed information regarding help desk including address of mill management officials and cane development department officials.

(9) Detailed information of cane command area and supplier details of sugar mills including number of cane purchasing centres and number of supplier members.

The SIS, comprising of website at sugar mills, password protected webpage for all cane growers supported by mobile text messages (SMSs) and IVRS, has accomplished the gigantic task to make online around 150 million annual transactions/ interactions among 3.0 million sugarcane farmers, 125 sugar mills and 168 cane cooperative societies engaged in the marketing of sugarcane worth ₹ 1,50,000 million (US $ 3000 million) annually. Right from the selection of suitable sugarcane variety for planting, to harvesting and finally, the transfer of cane price to their bank accounts - all the intermediate steps have been made available online.



Impact on timeliness

The use of ICT on this massive scale has transformed the way in which the Sugarcane Department interacts with the growers of sugarcane and the sugar mills. The SIS has enabled the Cane Department to perform its role to the complete satisfaction of the sugarcane farmers. The SIS has made available up-to-date information about the 150 million interactions between the sugar mills and the farmers to all its stakeholders. The information provided about these interactions is instantaneous, accurate and valuable. Table 10 gives the average time taken to carry out one service transaction per cane grower per annum. It varies from one week to one month. The SIS provides even the vital information within seconds of the transaction.

Table 10. Saving in time of farmer-sugar mill interactions

S. No.	Activity	Time Taken before SIS	Time Taken after SIS
1	Survey of fields	1 Month	1 second
2	Calendar of supply	1 Week	1 second
3	Start of sugar mills/centres	3 Days	1 second
4	Supply Tickets	3 Days	1 second
5	Weighing of sugarcane	1 Day	1 second
6	Payment of sugarcane	2 Weeks	1 second
7	Development & other activities	1 Month	1 second

The number of complaints regarding interactions has reduced dramatically. As per information available with the Cane Department, the average number of errors detected in the service transactions carried out yearly were about 50,000 on an average. Now errors are detected quickly due to implementation of SIS and the transparency in the system. The average number of complaints received (formally or informally) from farmers after SIS has come down dramatically. The ready availability of information has cut down the role of middle level government officials leading to reduction in red tape and corruption. Many layers of the administrative machinery detrimental to the growth of the sugar sector have been eliminated. The efficiency of the Cane Department (monitoring) have increased significantly. There is a complete paradigm shift in efficiency, accuracy, timeliness and competence ushered in by this e-Governance project. As a result, the Sugarcane Department's overall image has emerged as a citizen-centric facilitator to the growth of the sugar sector in the state.

The capital cost and recurring expenditure for the SIS is borne by the sugar mills. Therefore, the SIS has been implemented without any budgetary support from Government. It also led to the promotion of IT literacy amongst rural masses.

11. Sustainability of SIS

The SIS has accomplished the gigantic task by making online around 150 million annual transactions/interactions between 3.0 million sugarcane farmers, 125 sugar mills and 168 cane cooperative societies engaged in the marketing of sugarcane worth ₹ 1,50,000 million (US $ 3,000 million) annually. It has reduced the number of farmers' drudgery inducing visits to sugar mills significantly, and the desired information is provided instantly and accurately to the farmers. It has also avoided the wastage of time and money in these visits. The efficiency of sugar mills (crushing) and that of the Cane Department (monitoring) have increased significantly. Many layers of the administrative machinery detrimental to the growth of the sugar sector have been eliminated. The farm-factory relations have improved a lot. The SIS has been functional for the last two years and the numbers of complaints regarding the farm-factory interactions have reduced dramatically. All these peculiarities associated with the SIS have resulted in winning the appreciation of the system by the farmers and their confidence in cane supply arrangements provided by the sugar mills. The growers need regular information about the date and quantity of the cane to be supplied, so they will be the regular users of the services offered in SIS and will continue to prefer these improved services compared to the earlier system. The SIS is, thus, socially and technologically acceptable to all stakeholders.

The SIS has been implemented without any budgetary support from the Government, at no cost to the Department as its entire expenditure has been borne by the sugar mills which are the delivery centres. The sugar mills are gaining considerably in financial terms by the use of SIS. The annual financial gains to the sugar mills from the implementation of SIS are many times more than the cost of the project and annual recurring charges. The yearly monetary benefits to the farmers are around ₹ 8,465 million (US $ 169.3 million) without any cost involvement. The SIS is, thus, financially sound and viable. The win-win solution to all stakeholders provided by SIS ensures its sustainability.

There is a complete paradigm shift in efficiency, accuracy, timeliness and competence ushered in by this e-Governance project. The SIS is helpful in improving the

overall productivity, the cane productivity, sugar recovery in mills, farmers' income and that of sugar mills by effecting no additional cost to the Government. It is also helpful in improving the efficiency in terms of farm-factory interactions, efficiency in the functioning of the sugar mills and that of the government departments by raising per worker productivity. It has also helped in improving the regulatory efficiency of the Department. In a nutshell, the SIS has improved the overall image of the Department as a citizen-centric growth facilitator.

The implementation of SIS has made all the transactions/interactions between farmers and the sugar mills online and reduced most of the paper work done by manual help desk. By reducing the use of paperwork, the SIS is environment friendly too.

The technological features of SIS has the provision to link to the websites of other Departments/research organizations so as to provide additional edge on establishing effective liasion with all related Departments so that necessary technical guidance be disseminated to growers for enhancing the cane productivity. It also led to the promotion of IT literacy amongst rural masses, irrespective of land holding size and literacy spectrum. Hence, it has an educative element in it also.

The SIS is, therefore, sustainable as it is financially viable, technologically accessible, socially acceptable, administratively efficient, user-friendly, and can be replicated in other Departments/areas to effect a paradigm shift in its overall functioning.

12. Conclusion

The Indian Institute of Sugarcane Research (IISR) by carrying out an impact assessment of the Sugarcane Information System (SIS) developed by the Uttar Pradesh State Sugarcane Department on the basis of a rapid appraisal of some randomly selected sugar mills and farmers concludes that:

- ***Largest rural IT network:*** In order to bring efficient sugarcane marketing management, the Sugarcane Commissioner by making use of the ICT, developed the Sugarcane Information System (SIS) in 2010 as a unique and collaborative project of Government, sugar mills and the sugarcane marketing societies. It is one of the largest rural information technology (IT) network in the India, framed on the principles of partnerships and collaborations, which provides a comprehensive platform to 3.0 million sugarcane farmers to interact with 125 sugar mills through 168 cane cooperative societies engaged in the marketing of sugarcane worth ₹ 1,50,000 million (US $ 3000 million) annually. The components of SIS include

website adopted by sugar mills to act as independent delivery centres, password protected webpage for all (3 million) cane growers supported by mobile text messaging system (SMS) and Interactive Voice Response System (IVRS). In addition, there is an added feature of the use of Hand Held Computer (HHC) at all 7,000 outstation purchase centres for automatic recording of cane weighment and purchase transaction details.

- ***Transparency and accuracy:*** The physical interactions of the farmers with the sugar mills right from sowing, harvesting, sale and payment are critical event on which depends the livelihood security of the farmers. There are around 53 interactions annually between the farmers and the sugar mills at an individual farmer level. These amount to over 150 million farm-factory interactions at the state level. Any loss of interaction leads to a financial loss both to the sugar mills as well as the farmers. Under SIS, these interactions can be accessed *via* three mediums *viz.*, Websites, SMS and Query SMS system and IVRS. The communication about the interaction has also become very fast. Immediately after an interaction, the SIS immediately updates the websites and IVRS database while instantly sending the confirmatory SMS. These mediums have benefitted the farmers equally irrespective of their size of land holding and literacy spectrum. The timely communication of each interaction has led to an annual saving of income of farmers worth ₹ 8,465 million (US $ 169.3 million).
- ***Free of cost service:*** Government reforms are generally public funded. The SIS has been implemented without any budgetary support from Government. Every sugarcane grower has gained equally from SIS, and the services to them are free of cost. The capital cost and recurring expenditure for the SIS is borne by the sugar mills. The SIS has benefitted the sugar mills too in respect of increase in cane supply and sugar recovery levels, and there is an increase in annual income of around ₹ 7,971 million (US $ 159.43 million) to the sugar mills.
- ***Efficiency and reduction of layers of Government:*** The use of ICT on this massive scale has transformed the way in which the Sugarcane Department interacts with the growers of sugarcane and the sugar mills. It has enabled the Cane Department to perform its role to the complete satisfaction of the sugarcane farmers. Now, all information is available round the clock at the click of a button on the farmers' mobile or a computer. It frees the department as well as the farmers to focus their valuable time upon other productive agricultural practices. The SIS has made

available up-to-date information about the 150 million interactions between the sugar mills and the farmers to all its stakeholders. The information provided about these interactions is instantaneous, accurate and valuable. The ready availability of information has cut down the role of middle level government officials leading to reduction in red tape and corruption. Since the implementation of SIS, the numbers of complaints regarding interactions have reduced dramatically.

- ***Sustainability:*** The new intervention SIS as an ICT tool in cane supply management for sugar mills in UP is sustainable, as it is socially acceptable and relieves the farmers of the drudgery associated with the manually operated system and associated long queues while making cane supply to the mills. The SIS, has been functional for the last two years and is constantly evolving and improving itself. All the stakeholders are getting substantial financial benefits from the initiative which ensures the sustainability of SIS. The financial savings made by the sugar mills from the implementation of SIS are many times more than the cost of the project.
- In essence, the SIS is an e-Governance initiative par excellence and is set to improve financial health of farmers and sugar industry of the state. Hence, SIS is financially viable, technologically accessible, user-friendly and socially acceptable. These advantageous features of SIS will go a long way to transform the sugar sector. The huge success of SIS can be successfully replicated/applied to other spheres of the Government.

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