

ICT Platform for Enhancing Agricultural Productivity: The case study of Tata Kisan Kendra

Vivek Talwar, Nrupesh Mastakar and B. Bowonder

Abstract

The potential for application of ICT in the agro-sector is high. The new tools and techniques are evolving and the implications of that are clearly visible at the global scale. But the level of penetration of ICT is very low in India since the rural masses are not aware of the new technological innovations. The private initiative taken by Tata Chemicals Ltd started with an objective of providing the farmers with infrastructure support, operational supports, co-ordination and control of farming activities, and strategic support. Tata kisan Kendra has been replicated successfully in states of Uttar Pradesh, Haryana and Punjab. The project has generated learning experiences such as customization of the project for the rural users, implementation in a phased manner and community learning. The project is scalable and replicable, which Tata Chemical Ltd is keenly look forward to. It has also managed to look into the economic and cultural sensitivities.

Keywords

Remote sensing Technology, Geographic Information System, Ground truthing, precision-farming.

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Introduction

India traditionally is an agrarian economy, where nearly 40% of the country's GDP comes from the agriculture sector and its other allied sectors. Most of the farmers employed in this sector are poor as the income is highly seasonal and depends on the climatic conditions. Lately, the farmers from across the country are resorting to the use of Information Communication Technology for increasing their productivity and the revenues. The scope of ICT for the helping the rural farmers has increased, the farmers have become aware of the benefits that they will derive from use of ICT tools, also the private initiatives taken by large business houses such as Tata and ITC have helped in increasing the penetration of ICT to the grass-root levels.

Tata Kisan Kendra (TKK) was the initiative taken on the same lines to help the farmers to improve that quality of life of the farmers [1]. Tata Chemicals Ltd started TKK with a credo to:

“To provide the farmer with a package of inputs and services for optimum utilization of balanced primary nutrients; plant protection chemicals; water; seeds; post-harvest services; and to develop a genuine partnership with the farmer”

TKK today is operating in three states, namely: Uttar Pradesh, Haryana and Punjab. It is active in providing the sophisticated modern technology to the small farmers and making them harness the gain from ICT. This case study identifies the factors contributing to the success of the agro-centers and assess the impact of Tata Kisan Kendra on the rural farmers [2]. ‘Tata Kisan Kendras’ are rural centres through which farmers can access the information through an ICT platform that Tata chemicals Ltd has designed and implemented. It also provides lessons on how other corporate houses can learn from the experience of Tata Chemicals and replicate it in the other parts of the country.

Overview of Tata Chemicals

Established in 1939, Tata Chemicals Limited (TCL) is one of India's leading manufacturers of inorganic chemicals and fertilizers [3]. It is a part of the Rs 521000 million (US\$ 11 billion) Tata group. The company owns and operates the largest and most integrated inorganic chemical complex in the country. It also runs a fertilizer project that has won many awards

for energy conservation, productivity and safety. The chemical complex is in Mithapur, Gujarat, and the fertilizer division is located in Babrala, Uttar Pradesh.

Tata Chemicals is today widely acknowledged as a leader that sets the technological standard in the chemicals and fertilizer industries. It has a turnover of Rs 17070 million (2002-03), employs over 3,000 people. TCL started out by setting up a chemicals plant at Mithapur in the Okhamandal district of Gujarat state on the west coast of India. The plant has since grown into a chemicals behemoth with an installed capacity of 8,75,000 tonnes of soda ash per annum, about 42 per cent of the country's capacity. That makes the company one of the largest producers of synthetic soda ash in the world.

Tata Chemicals has a broad portfolio consisting of Soda Ash, Gypsum, Soda Bicarbonate, Salt, Bromine, Urea and Cement. Tata Chemicals enjoys a market share of about 38 per cent in its principal product, soda ash. The total production of soda ash alone accounts for 8,00,000 tonnes per annum (tpa). In addition to this, the company's chemicals complex in Mithapur produces 3,50,000 tpa of vacuum-evaporated salt, 33,000 tpa of caustic soda and 180 tpa of bromine and bromine-based compounds. The company has achieved this by attaining 100 per cent self-sufficiency in major raw materials, energy and water requirements.

In the area of fertilizers, Tata Chemicals has the distinction of setting up the first urea plant in the country with a 'dual feedstock facility' — natural gas or naphtha, or a combination of both. Listed below are the categories of products that the company produces from Mithapur and its fertilizer division in Babrala.

Overview of Tata Kisan Kendra (TKK)

TKK was the initiative of the Tata Group under the auspices of Tata Chemicals to harness the technological proves for solving India's social and economical problems. The concept of precision farming being implemented by the TKKs has the potential to catapult rural India from the bullock-cart age into the new era of satellites and IT. TCL's extension services, brought to farmers through the TKKs, use remote-sensing technology to analyze soil, inform about crop health, pest attacks and coverage of various crops predicting the final output. This helps farmers adapt quickly to changing conditions. The result: healthier crops, higher yields and enhanced incomes for farmers.

Staff members at each kendra are equipped to find solutions to every agriculture-related problem. A well-stocked library of journals and magazines helps farmers keep abreast of

news and the latest global developments. In addition, the kendras mail regular bulletins on farm-related news to subscribers. The training halls at the TKKs are used for workshops and the screening of films related to agriculture. The TKK network runs crop clinics where agronomists use computers to access information from the geographic information system (GIS) and advise farmers on what to grow, where and when to grow it, and how much urea and nutrients to use. At the soil-testing laboratory, technicians analyze soil samples to determine their composition and confirm what the satellite maps have indicated. Additionally, the TKK network operates experimental farms where scientists conduct agricultural research and development. TKKs stock seeds, pesticides and fertilizers that farmers can buy at affordable prices, and they lease out farm equipment and implements to farmers who cannot afford to buy expensive modern machinery. One of the biggest worries for small farmers in India is finance. The kendras take care of this need too. Farmers can get credit, insure their crops against natural disasters, and even avail of buyback facilities.

The kendras also have exhibition halls where special events — educational, social or just pure entertainment — are held for members of the Tata Kisan Parivar (Tata Farmers Family), an organization promoted by the TKK network to build relationships with farmers and their families.

The unique, end-to-end solutions offered by the Tata Kisan Kendras go beyond providing services and products to India's agricultural community. With their technological innovations, farming know-how and social commitment, these one-stop centres for agricultural solutions are changing the face of rural India. Tata Kisan Kendra is offering wide-range of services. The services offered are for the entire value-chain of farming. The service offerings are shown in **Fig 1**.

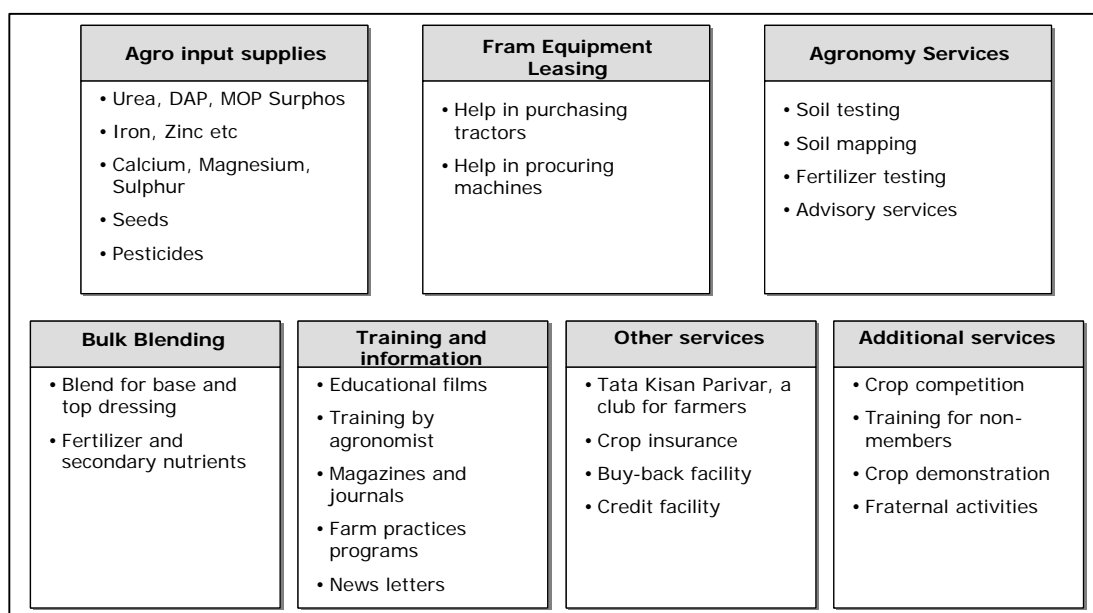


Fig. 1. Service Offering Tata Kisan Kendra

Project Idea and Initiation

Tata Chemicals with the objective of providing the farmers high quality services, providing them with healthier crops, higher yields and enhanced incomes mooted the idea to use high-end technology to achieve its ultimate goal of "Improving the quality of Life of the farmers". TTK introduced the concept of precision farming, with an idea to catapult the rural India from the age of bullock cart into the new age of satellites and information technology. The concept involved designing and implementing an ICT platform through which the farmers could access markets, access information and access expertise. The value addition comes through the use of GIS, along with other on-line services, specially designed to meet of the farmers needs. The GIS technology helps the farmer to adapt quickly to the changing conditions in the soil and climate. The GIS methodology is explained subsequently in the case. This precision farming project leverages on modern satellite and information technology to serve the needs of the Indian farmers. The operation involves combining satellite maps, census data, socio-economic and other data collected within the GIS. The aim was to create a value-added agricultural database [4].

Project Conceptualization

The Precision Farming project was conceptualized by TTK to provide end-to-end solutions to the farmers. Practices that integrate the TTK are shown in **Fig 2**.

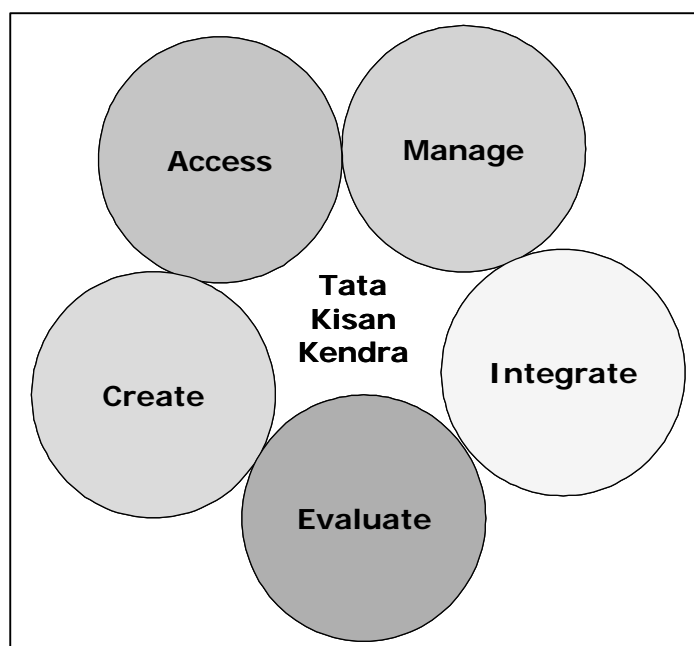


Fig 2: Practices at TTK

The practices followed by TTK are shown in the **Fig 2**. TTK has played a pivotal role in giving the rural farmers access to the latest ICT tools, knowledge above modern farming technologies and information from the agri-database created by agronomists. It helps in managing the existing knowledge base of the rural masses and updating it by synergizing the processes between the farmers and the local centers of TTK. TTK integrates the knowledge and techniques of the modern farming and local knowledge for enhancing the productivity of the rural farmers; it also regularly evaluates the performance of the farmers and also gives value suggestions by conducting workshops and clinics for imparting the latest knowledge. TTK also creates a conducive environment to harmonize the research and development, making the rural masses aware of the new tools and techniques. With this in view, they developed and implemented an ICT platform, which can provide various services to farmers. Such a comprehensive system has to be conceptualized, validated and implemented.

Total Solutions to farmers

The agricultural productivity is low in many states. The objective of this project has been to provide a platform that can provide support services and value added services to farmers.

GIS mapping was the main standout point in this ICT initiative, GIS or the geographic information systems, are computerized systems that record, store, analyze and produce maps and geographic products based on information obtained from the different sources. The TKK's precision-farming concept uses GIS to manage and analyze data collected from different sources by various means, sophisticated and simple. The information thus collected includes census data, revenue data, socio-economic surveys, satellite imagery, soil-mapping data and market studies. The satellite mapping helps the vendor organization and the farmers to achieve the objectives such as:

- Speed for the conducting the ground surveillance than that done by the airplane and also the comprehensiveness of the surveillance
- Accuracy attained through satellite mapping is more than the traditional processes
- Flexibility in adapting to the changing ownership patterns, climate and soil changes
- Remote-sensing ability is the latest advancement in satellite mapping

The Tata Kisan Kendra (TKK) network has collected census data for the districts in which they operate. This information is combined with the spatial data generated by the GIS facility and correlated with socio-economic information such as the name of the owner of a plot of land, the crop grown on it, the number of members in the family, the family's level of education, its annual income, and so on.

Both raw and processed data is fed into the GIS, which then becomes the basis for providing quality decision support for the agronomy services offered by the TKKs. The agronomist at the Kendra uses analyzed information on topography, soils, climate, hydrology, cropping systems and crop suitability to advise farmers on which crops to grow, crop management, market trends, what kind of fertilizers to use and how much, etc. The goal is to maximize the yield from a farmer's land holding, and thereby improve his socio-economic standing.

Collecting and converting the data from various sources into useful information is a complex, time-consuming task, as the GIS pilot project conducted in Uttar Pradesh state revealed:

- Revenue map information was collected by tracing maps and copying data relating to farm sizes and land ownership. This information was then converted into digital data by digitization of maps and data entry of socio-economic data.

- Other spatial data was collected through satellite imagery. Tata Chemicals purchased and used satellite pictures of the area from the National Remote Sensing Agency, Hyderabad.
- These images were then sent to the Indian Resources Information and Management Technologies for processing and classification.
- Next came 'ground-truthing', which means validating the satellite images on the ground, finding out, for instance, whether the wheat growing area indicated in the map actually grows wheat. Similarly colored codes in the maps would indicate similarities in vegetation, soil content, etc.

In a **figurative** way, the GIS software works by superimposing layers of data in digitized maps with information about the administrative, socio-economic and physical set-up. The source of these maps also includes data from satellite image processing.

When the data-building exercise for the precision-farming project is completed, it will reduce the complex task of selecting, mapping and testing land holdings in the command area of the TKKs to a few clicks of the mouse. The satellite mapping process is shown below:

The initial screen of the GIS Software shows the view of the entire state, as shown in **Fig. 3**, here the user gets the choice of selecting the location he wants to select from the state. Uttar Pradesh is one of the three states where such GIS mapping is introduced by Tata Chemicals, the other two states are Haryana and Punjab.



Fig 3: The view of the state

The user then selects the location that he wants to analyze, as shown in **Fig 4**



Fig 4: The selected location for further analysis

The user can further, penetrate the area for analysis, as shown in **Fig 5**:



Fig 5: Further selection of the area

The user has the option of selecting the villages from the district as shown in **Fig 6**:



Fig 6: Selecting the villages from the district

The user has the option of selecting the village as per the economic profile of the village, as shown in **Fig 7**:

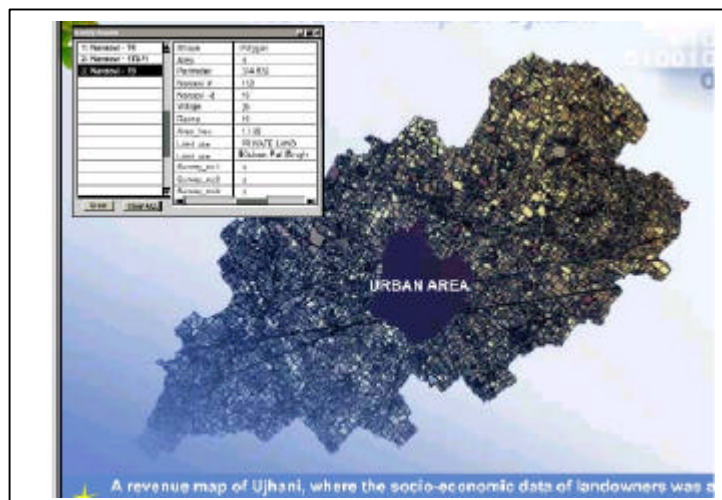


Fig 7: Digitized map of the village showing the socio-economic distribution pattern

The user can further select the area and get data on the soil-patterns and fertility according to the owners, as shown in **Fig 8**:

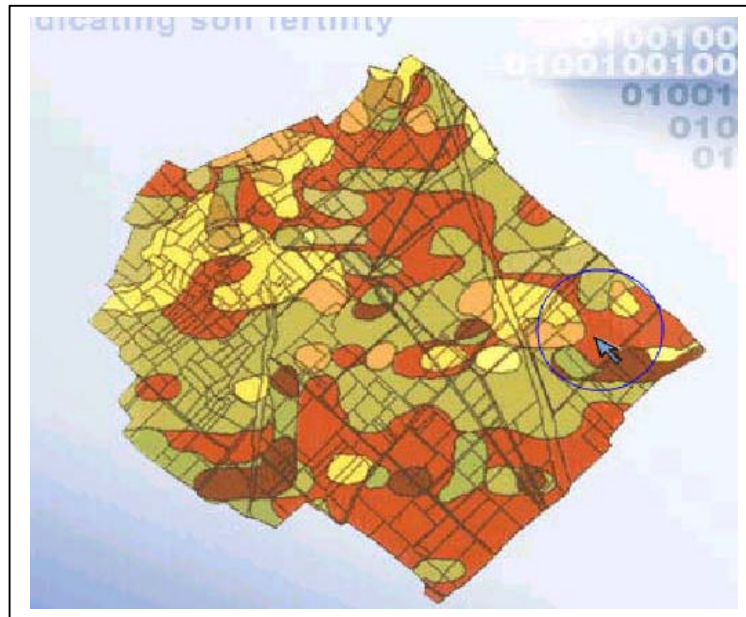


Fig 8: The soil-pattern and fertility according to the landowners

The agronomist can further get the information from the landowners such as the crop grown by him in the last season, farmers annual income, the soil fertility, and soil texture. The agronomist gives suggestions to the farmer depending on the information and analysis done by him on the information he got from the farmer, as shown in the **Fig 9**:

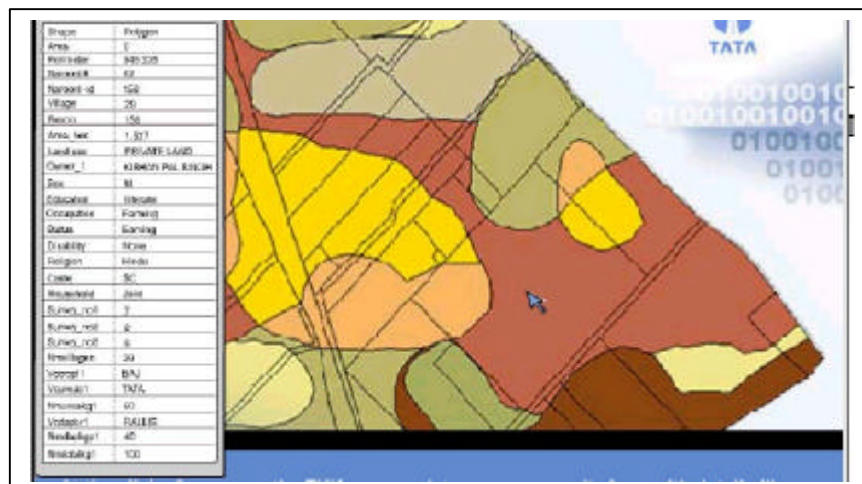


Fig 9: Details of the farmer

The ICT platform helps in integrating all the information of a farm. The ICT platform helps in providing total solutions to farmers. The model has been tested and validated.

Benefits to the Farmers

The farmers from the states of Uttar Pradesh, Punjab and Haryana have benefited in multiple ways. TKK has been pivotal in providing value-added services to these farmers, which has helped in uplifting these farmers and improving their quality of living. The benefits derived by the farmers are shown in the **Fig 10**:

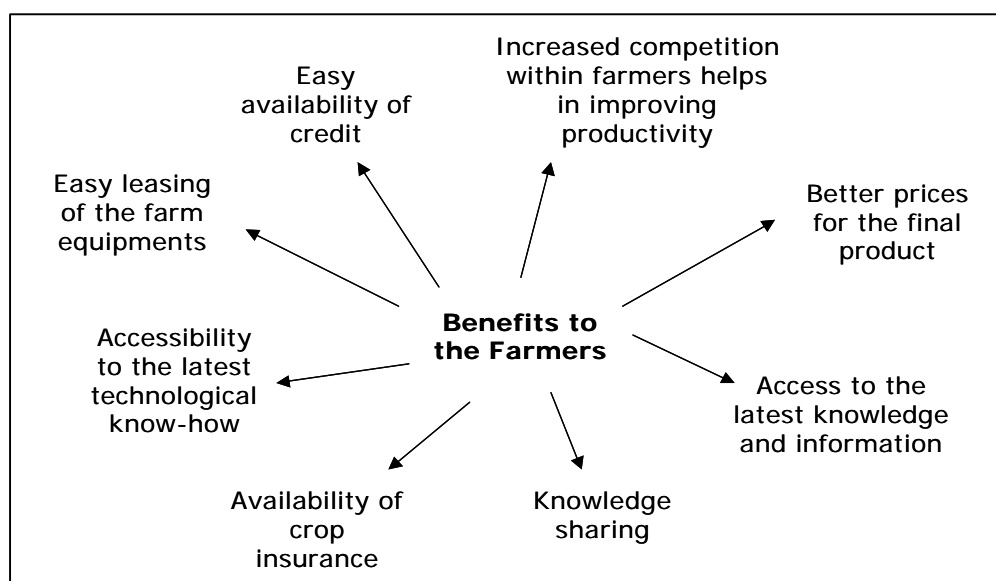


Fig 10: Benefits to the Farmers

Farmers has benefited in many ways from the implementation of the ICT platform. Some examples illustrates the utility of the platform.

- Mr. Ramprakash, from the Bijua Nagla village is a small farmer with a cultivable land of one and half acre. When he visited the TKK in his village, the agronomists from the centre helped him in assessing the soil-fertility of his land and the crops that he can grow. Ramprakash accepted the suggestions and he cultivated high-yield variety of chilli and peas. The yield helped him to repay the loans. TKK assisted the farmer to map his soil-fertility and propose a set of crops that can maximize his earnings.
- Mr. K. K. Gupta has ten acres of land in Baduan district. TKK assisted him in deriving the best time to cultivate the crop, determining the soil-fertility and giving the best quality seeds and fertilizers. The suggestions given by TKK helped Mr. Gupta in

improving his productivity phenomenally and generating additional marginal revenues by cultivating cash crops in off-seasons.

- Surendra Uttam is a potato farmer from Kanpur. His crop had been continuously spoiled epidemics and pests. Agronomists from TTK advised him on use of modern techniques and use of urea and pesticides. This helped Mr. Uttam for improving the productivity and keeping his crop free from pests.

In addition to the value-added services, TTK also proactive in educating the farmers about the latest trends in modern farming happening around the world. TTK centers in the three states have well-stocked library of journals and magazines helping the farmers to keep themselves abreast with the news and latest developments. TTK regularly organizes training programs and workshops for imparting modern agronomic practices.

The TTK network runs crop clinics where agronomists use computers to access information from the geographic information system and advise farmers on what to grow, where and when to grow it, and how much urea and nutrients to use. At the soil-testing laboratory, technicians analyze soil samples to determine their composition and confirm what the satellite maps have indicated. Additionally, the TTK network operates experimental farms where scientists conduct agricultural research and development. ICT platform has helped TTK to provide integrated and reliable solutions that are knowledge based. The case study illustrates the power of platforms.

Replicating the Experience

Tata Chemicals has been proactive in replicating its success of TTK in other states. The pilot phase showed that the concept is working well. More and more areas are being covered subsequently. Currently the TTK's network is spread in three states viz. Uttar Pradesh, Haryana and Punjab. It is trying to increase the reach of the network to the deeper villages and enhancing the services offered to the farmers. GIS is playing a vital role in assessing the soil patterns, fertility and cultivable land; TTK is actively trying to widen the scope and reach of the GIS facility to other centers and untapped areas. Currently there are 11 mother TTKs and about 300 franchisee TTKs. Tata Chemicals is actively looking to setup 40 mother TTKs and 800 franchisees, to look after the needs of 48,000 villages in the three states. The characteristics of the current network of TTK are shown in **Table 1**.

Table 1: The characteristics of the current network of TKK

Total Area	39 million hectares
Gross cultivated area	39 million hectares
Net cultivated area (64% of total area)	25 million hectares
Gross irrigated area (72% of total area)	28 million hectares
Total population	176 million
Rural population (78% of total population)	138 million
Number of farm holdings	23 million
Average farm size	2.3 hectares
Cultivators per farm	1.2 people

Conclusion

The scope of using ICT for the agricultural sector is high. Given the current scenario the penetration of the latest tools provided by ICT is very low in India, but the private initiatives taken by the private sector players such as Tata and ITC have been pivotal in increasing the awareness of ICT to the rural masses. Groups like Tata and ITC have been concentrating on the agriculture to foster the socio-economic growth of the rural masses and also to sustain their own in the future as in India, 40% of the GDP is still derived from the agro-sector.

Tata Chemicals, the Tata Group company embarked upon the ICT initiative viz. Tata Kisan Kendra to provide:

- infrastructure support
- operational support
- coordination and control and
- strategic support

The experience of Tata chemicals Ltd has a series of lessons for other corporates. They are discussed here

- Conceptualizing ICT platforms have to done after consulting the users. Agricultural practices are crop specific and region specific. ICT platforms have to be specifically customized for the user needs
- Development of ICT platforms have to done in a phased manner so that the project grows in an evolutionary manner. Starting the project in a pilot phase and then validating it and then expanding it is the best way for making sure that a project concept works in real life
- The crucial aspect of ICT in rural areas is that the contact person should develop working relationship and trust at the grass root level.

Designing ICT platforms for agricultural systems have to be done very systematically [6]. Relationships have to be developed with the users and platform holders. The executives dealing with farmers need to be sensitive about the socio economic and cultural sensitivities.

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