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G. S. PAPER-III: ECONOMIC DEVELOPMENT

- **Agricultural Marketing: Issues and Related Constraints**
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- **e-Agriculture : e-Technology in The Aid of Farmers**

Agricultural Marketing: Issues and Related Constraints

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Introduction

The term agricultural marketing is composed of two words -agriculture and marketing. Agriculture, in the broadest sense means activities aimed at the use of natural rural resources for human welfare, and marketing connotes a series of activities involved in moving the goods from the point of production to the point of consumption. Specification, the subject of agricultural marketing includes marketing functions, agencies, channels, efficiency and cost, price spread and market integration, producer's surplus etc. The agricultural marketing system is a link between the farm and the non-farm sectors.

In India Agriculture was practiced formerly on a subsistence basis; the villages were self sufficient, people exchanged their goods, and services within the village on a barter basis. With the development of means of transport and storage facilities, agriculture has become commercial in character; the farmer grows those crops that fetch a better price. Marketing of agricultural produce is considered as an integral part of agriculture, since an agriculturist is encouraged to make more investment and to increase production. Thus there is an increasing awareness that it is not enough to produce a crop or animal product; it must be marketed as well.

Agricultural marketing involves in its simplest form the buying and selling of agricultural produce. But, in modem times, marketing of agricultural produce is different from that of olden days. In modem marketing, agricultural produce has to undergo a series of transfers or exchanges from one hand to another before it finally reaches the consumer.

The National Commission on Agriculture defined agricultural marketing as a process which starts with a decision to produce a saleable farm commodity and it involves all aspects of market structure of system, both functional and institutional, based on technical and economic considerations and includes pre and post- harvest operations, assembling, grading, storage, transportation and distribution. The Indian council of Agricultural Research defined involvement of three important functions, namely (a) assembling (concentration) (b) preparation for consumption (processing) and (c) distribution.

Characteristics of Agricultural Product

Agricultural products differ in nature and contents from industrial goods in the following respects.

- Agricultural products tend to be bulky and their weight and volume are great for their value in comparison with many industrial goods.
- The demand on storage and transport facilities is heavier, and more specialized in case of agricultural products than in the case of manufactured commodities.
- Agricultural commodities are comparatively more perishable than industrial goods. Although some crops such as rice and paddy retain their quality for long time, most of the farm products are perishable and cannot remain long on the way to the final consumer without suffering loss and deterioration in quality.
- There are certain agricultural products such as mangoes and grapes which are available only in their seasons but this condition of seasonal availability is not found in the case of industrial goods.
- Agricultural produce is to be found scattered over a vast geographical area and as such its collection poses a serious problem. But such is not condition in the case of industrial goods.
- There are various kinds and varieties in farm produce and so it is difficult to grade them.
- The farmers especially in countries like India have low holding-back. Therefore he has to sell his produce immediately after the harvest at whatever price he can fetch because of his pressing needs.
- Finally, both demand and supply of agricultural products are inelastic. A bumper crop, without any minimum guaranteed support price from the government may spell disaster for the farmer. Similarly the farmer may not really be in a position to take advantage of shortages or deficit crop. These benefits may pass on only to the middleman.

Importance and Objectives of Agricultural Marketing

The farmer has realized the importance of adopting new techniques of production and is making efforts for more income and higher standards of living. As a consequence, the cropping pattern is no longer dictated by what he needs for his own personal consumption but what is responsive to the market in terms of prices received by him. While the trade is much organized the farmers are not Farmer is not conversant with the complexities of the marketing system which is becoming more and more complicated. The cultivator is handicapped by several disabilities as a seller. He sells his produce at an unfavourable place, time and price.

The objectives of an efficient marketing system are:

- To enable the primary producers to get the best possible returns,
- To provide facilities for lifting all produce, the farmers are willing, to sell at an incentive price,
- To reduce the price difference between the primary producer and ultimate consumer, and
- To make available all products of farm origin to consumers at reasonable price without impairing on the quality of the produce.

Facilities Needed for Farmer in Marketing

In order to have best advantage in marketing of his agricultural produce the farmer should enjoy certain basic facilities.

- He should have proper facilities for storing his goods.
- He should have holding capacity, in the sense, that he should be able to wait for times when he could get better prices for his produce and not dispose of his stocks immediately after the harvest when the prices are very low.
- He should have adequate and cheap transport facilities which could enable him to take his surplus produce to the mandi rather than dispose it of in the village itself to the village money-lender-cum-merchant at low prices.

- He should have clear information regarding the market conditions as well as about the ruling prices, otherwise may be cheated. There should be organized and regulated markets where the farmer will not be cheated by the "dalals" and "arhatiyas".
- The number of intermediaries should be as small as possible, so that the middleman's profits are reduced. This increases the returns to the farmers.

Methods of Sale and Marketing Agencies

The marketing of agricultural produce is generally transacted in one of the following ways.

- **Under cover or the Hatta System:** - Under this system, the sale is effected by twisting or clasping the fingers of the sellers agent under cover of a cloth. The cultivator is not taken into confidence until the final bid is cleared.
- **Open auction syste:** - Under this system the agent invites bids for the produce and to the highest bidder the produce is sold.
- **Dara system:-** Another related system is to keep the heaps of grains of different quantities and sell them at fiat rates without indulging in weightment etc.
- **Moghum sale:-** Under this system, sale is based on the verbal understanding between buyers and sellers and without mentioning the rate as it is understood that the buyers will pay the prevailing rate.
- **Private agreement:** - The seller may invite offers for his produce and may sell to one who might have offered the highest price for the produce.
- **Government purchase:** - The government agencies lay down fixed prices for different qualities of agriculture commodities. The sale is affected after a gradual processing for gradation and proper weightment. This practice is also followed in co-operative and regulated markets.
- **Marketing agencies:-** The various agencies engaged in the marketing of agricultural produce can be classified into two categories, viz., (i) government and quasi private agencies like the co-operative societies and (ii) private agencies. A chain of middlemen may be found operating both in Government and private agencies.

Existing Systems of Agricultural Marketing in India

The existing systems of agricultural marketing in India are as briefly described here: -

- **Sale to moneylenders and traders:-** A considerable part of the total produce is sold by the farmers to the village traders and moneylenders. According to an estimate 85% of wheat, 75% of oil seeds in U.P., 90% of jute in West Bengal and 60% of wheat, 70% of oil seeds and 35% of cotton in Punjab are sold by the farmers in the villages themselves. Often the money lenders act as a commission agent of the wholesale trader.
- **Hats and shanties:-** Hats are village markets often held once or twice a week, while shanties are also village markets held at longer intervals or on special occasions. The agents of the wholesale merchants, operating in different mandies also visit these markets. Most of "hats" are very poorly equipped, are uncovered and lack storage, drainage, and other facilities. It is important to observe that only small and marginal farmers sell their produce in such markets. The big farmers with large surplus go to the larger wholesale markets.
- **Mandies or wholesale markets:-** One wholesale market often serves a number of villages and is generally located in a city. In such mandies, business is carried on by arhatiyas. The farmers sell their produce to these arhatiyas with the help of brokers, who are generally the agents of arhatiyas. Because of the malpractices of these middlemen, problems of transporting the produce from villages to mandies, the small and marginal farmers are hesitant of coming to these mandies. The arhatiyas of these mandies sell off the produce to the retail merchants. However, paddy, cotton and oilseeds are sold off to the mills for processing. The marketing system for sugarcane is different. The farmers sell their produce directly to the sugar mills.
- **Co-operative marketing:-** To improve the efficiency of the agricultural marketing and to save farmers from the exploitation and malpractices of middlemen, emphasis has been laid on the development of co-operative marketing societies. Such societies are formed by farmers to take advantage of collective bargaining. A marketing society collects surplus from it members and sell it in the mandi collectively. This improves the bargaining power of the members and they are able to obtain a better price for the produce. In addition to the sale of produce, these societies also serve the members in a number of other ways.

Ideal Marketing System

The ideal marketing system is one that maximizes the long run welfare of society. To do this, it must be physically efficient, otherwise the same output could be produced with fewer resources, and it must be electively efficient, otherwise a change in allocation could increase the total welfare and where income distribution is not a consideration.

For maximum physical efficiency, such basic physical functions as transportation, storage, and processing should be carried on in such a way so as to achieve the highest output per unit of cost incurred on them. Similarly an ideal marketing system must allocate agricultural products in time, space and form to intermediaries and consumers in such proportions and at such prices as to ensure that no other allocation would make consumers better off. To achieve this condition, prices throughout the marketing system must be efficient and must at the same time be equal to the marginal costs of production and marginal consumer utility.

The following characteristics should exist in a good marketing system.

- There should not be any government interference in free and market transactions. The method of intervention include, restrictions on food grain movements, restrictions on the quantity to be processed, or on the construction of processing plant, price supports, rationing, price ceiling, entry of persons in the trade, etc. When these conditions are violated, the inefficiency in the market system creeps in and commodities pass into the black market. They are not then easily available at the fair prices.
- The marketing system should operate on the basis of the independent, but systematic and orderly, decisions of the millions of the individual consumer and producers whose lives are affected by it.
- The marketing system should be capable of developing into an intricate and far-flung marketing system in view of the rapid development of the urban industrial economy.
- The marketing system should bring demand and supply together and should establish equilibrium between the two.
- The marketing system should be able to generate employment by ensuring the development of processing industries and convincing the people to consume more processed foods, consistent with their tastes, habits and income levels.

Principles of Scientific Marketing for Farmers

The tendency among the farmers to market their produce has been increasing. Production is complete only when the produce is marketed at a price remunerative to the farmer. Increasing specialization in production of higher marketable/ marketed surplus of the produce and alternative channels of marketing has increased the importance of the marketing activity for the farmers. However, marketing activity should be guided by certain basic principles which are briefly explained. The farmers can gain more if they follow the following principles of scientific marketing: -

- **Always bring the produce for sale after cleaning it: -** Impurities, when present, lower the price offered by the traders-buyers in the market. The fall in price is more than the extent of impurity present in the produce would warrant. Clean produce attracts more buyers.
- **Sell different qualities of products separately: -** The produce of different varieties should be marketed separately. It has been observed that when different varieties of products are marketed separately, the farmers get a higher price because of the buyer's preference for specific varieties.
- **Sell the produce after grading it: -** Graded produce is sold off quickly. The additional income generated by the adoption of grading and standardization is more than the cost incurred in the process of grading and standardization. This shows that there is an incentive for the farmers for the production of good quality products.
- **Keep abreast of market information: -** Price information helps him to take decisions about when and where to sell the produce, so that a better price may be obtained.
- **Carry bags/packs of standard weights: -** Farmers should weigh their produce and fill each bag with a fixed quantity. Majority of the farmers do not weigh their produce before taking it for sale and suffer loss by way of a possible malpractice in weighing, or they may have to make excess payments in transit (octroi, transport costs, etc.).
- **Avoid immediate post-harvest sales:-** The prices of the produce touch the lowest level in the peak marketing season. Farmers can get better prices by availing of warehouses facilities existing in their areas. Farmers can meet their cash needs by pledging the warehouse receipt to nationalized banks.

- **Patronize co-operative marketing societies:-** Farmers can get better prices by sales through a cooperative and marketing society and can avoid the possibility of being cheated. The cost of marketing particularly the transportation cost for farmers having a small quantity of marketable surplus is minimized, for transportation is arranged co-operatively by the society and the profit earned by the society is shared among its members.
- **Sell the produce in regulated markets:-** The farmers should take their produce for sale to the nearly regulated markets rather than sell them in village or unregulated markets. In regulated markets marketing charges are on very few items. They get the sales slips in the regulated markets, which show the quantity of the produce marketed and the amount of charges deducted from the values of the produce. Sales slips protect farmers against the malpractices of deliberate erroneous accounting or unauthorized deductions.

Impact of Globalization: Contract Marketing

The macro level changes due to the New Economic Policy have had a direct impact in the field of agricultural marketing. So the impact of globalization has been highlighted here. As a result of globalization substantial investments in new ventures are being made by national as well as international corporations. A number of foreign companies are slated to enter the Indian market through collaborations with the well known Indian companies like Eagle Agro-farms, Maxworth Orchards, etc. It is clear that the wholesaler in the fresh products market as well as the processor will prefer contract marketing tie-ups with the farmers for sourcing his supply requirements.

The concept of contract farming is not new to India. Several years back, contract marketing was successfully tried in respect of "Hima peas". 'MARKFED' of Punjab also operated a scheme of contract marketing for green peas, Agrecotec proposes to setup country-wide retail network of shops for fresh fruit vegetable marketing. Direct marketing to consumer is already being done by the Mother Dairy through its outlets in Delhi. The successful integration of production and marketing under Apni mandi scheme in Punjab and the marketing managements of 'FRESH' in Hyderabad are clear signs that contract marketing is going to be increasingly resorted to in the years to come. “Pepsi Foods" also an another example of contract farming of potatoes and tomatoes. Under this farming farmers will be producing specific varieties or qualities tailored to meet the requirements of the processor or the fresh produce market.

The potential benefits of the contract marketing are:-

- Producers can reduce the market risk,
- Post harvest losses can be reduced,
- Technology can be transferred to the producers,
- Contract serve as a security for increased access to credit by both producers and processors,
- Contract may create a greater sense of common interest among the producers and induce greater involvement in group activities etc.

Common problems may be: -

- Volatility in market price,
- There is risk that the processors may manipulate the quality standards,
- Coordination problems may be there regarding delivery of inputs or produce,
- Processors may lack the competence or capacity to deliver the require technical assistance,
- Producers may become tied to a contract relationship by virtue of debt, specialization, or the disappearance of other markets and may be unable to adjust their production activities to changing conditions etc.

Many of these problems of contract farming will not arise where goodwill and credibility exist between the farmers and the concerned company.

Government Measures to Improve Agricultural Marketing

Government of India has adopted a number of measures to improve agricultural marketing, the important ones being - establishment of regulated markets, construction of warehouses, provision for grading, and standardization of produce, Standardization of weight and measures, daily broadcasting of market prices of agricultural crops on All India Radio, improvement of transport facilities, etc. These are as briefly described here : -

- **Marketing surveys: -** In the first place the government has undertaken marketing surveys of various

goods and has published these surveys. These surveys have brought out the various problems connected with the marketing of goods and have made suggestions for their removal.

- **Rural Godown Scheme: -** The scheme of Rural Godowns has been formulated for creation of scientific storage capacity with allied facilities in rural areas by encouraging private and cooperative sector to invest in the creation of storage infrastructure in the country. The eligible promoters for construction of rural godowns are individual farmers, group of farmers/ growers, partnership/ proprietary firms, NGO, companies, corporations, cooperatives, Agricultural Produce Marketing Committees, Marketing Boards and Agro Processing Corporations. Godowns built under the scheme should be structurally sound on account of engineering considerations and functionally suitable to store the agricultural produce. The general conditions for scientific construction will be as follows:
  - The construction of godown should be as per Central Public Works Department/State Public Works Department specifications or any other standard specifications laid down in this behalf.
  - The godown should be properly ventilated, should have well fitted doors, windows and ventilators and should be waterproof (control of moisture from floor, walls and roof etc.)
  - The godown structure should have protection from rodents.
  - The godown should have protection from birds (windows / ventilators with jali).
  - The openings of godown such as doors, windows etc. should be designed in such a manner that the godown can be sealed for effective fumigation etc.
  - The godown complex should have an easy approach road, pucca internal roads, proper drainage, arrangements for effective control against fire and theft and also have arrangements for easy loading and unloading of stocks.
- **Grading and Standardization: -** The government has done much to grade and standardize many agricultural goods. Under the Agricultural Produce (Grading and Marketing) Act the Government has set up grading stations for commodities like ghee, flour, eggs, etc. The graded goods are stamped with the seal of the Agricultural Marketing Department -AGMARK. The "Agmark" goods have a wider market and command better prices.
- **Marketing Research & Information Network: -** This Central Sector Scheme was sanctioned by the Ministry Of Agriculture in March, 2000. The objective of the scheme is to establish a nationwide information network for speedy collection and dissemination of market data for its efficient and timely utilization; to ensure flow of regular and reliable data to the producers, traders and consumers to derive maximum advantage out of their sales and purchases, and to increase efficiency in marketing by effective improvement in the existing market information system.The AGMARKNET portal is continuously being enriched with other information related to agricultural marketing for the benefit of farmers and other market users.
- **AgmarkNet: -** Agricultural Marketing 'AgmarkNet' is a unique live portal on agricultural commodities anywhere in the world, technically supported by a high capacity Central server and the programming capabilities of the NIC and the data is fed into the system in a decentralized mode through the voluntary cooperation of mandi staff. This is acceptable since the aim of the network is to keep farmers and other market functionaries informed of price and market related information. The portal is in public domain and anybody can access information from the portal as per their requirement. The portal is becoming popular as the information related to different aspects of marketing. The market information from the portal is being broadcasted by various Television News Channels and published in News Papers for benefits of farmers and other stakeholders. Efforts are also being made for dissemination of market information in association with other service providers like IKSL, NOKIA and IIT, Kanpur (BSNL Telecom Center of Excellence)etc. through SMS and voice mode to the farmers and other beneficiaries.
- **National Agricultural Market Atlas (NAMA): -** National Agricultural Market Atlas (NAMA) is an offshoot of the AGMARKNET with an additional component of spatial data. It provides GIS web interface to visualize the daily market scenario on National Map. Overlaying the above information with the Road/Rail network makes it more meaningful and strengthens the decisions taken by the planner as well as the farmer. It provides details about market functionaries, market infrastructure, etc. in the form of map. The geographical distribution of the markets in conjunction with market parameters will be of immense help both the monitoring authorities and the farming community.
- **CCS National Institute Of Agricultural Marketing, Jaipur: -** The National Institute of Agricultural Marketing (NIAM) is a premier National level Institute set up by the Government of India in August 1988 to offer specialized Training, Research, Education and Consultancy in the field of Agricultural Marketing.

NIAM has been involved in collecting market based data for the project of National Agricultural Marketing Atlas (NAMA) from different states by providing training, creating database of various markets. The data has been collected with the co-operation of Officers and Staff of State Agricultural Marketing Boards, Directorate of Agricultural Marketing, Department of Agriculture, Department of Horticulture of various States.

- **Terminal Market Complexes: -** To encourage private sector investment in agriculture, the Union ministry of agriculture is setting up terminal market complexes (TMCs), which are reducing wastage of farm produce and thereby boosting supply. It provides facilities such as cleaning, sorting, packing, storage, cold chain and transportation. It encourages participation of private enterprises which are selected as promoters in the TMC project through competitive bidding and are eligible for subsidy. Private enterprise can be any individual or consortium, while producers' association can be farmer societies, registered NGOs, etc and the TMC project are being implemented as a separate company to be registered under the Companies Act, 1956.
- **Organization of Regulated Markets: -** Regulated markets have been organized with a view to protect the farmers from the malpractices of sellers and brokers. The management of such markets is done by a market committee which has nominees of the State Government, local bodies, arhatiyas, brokers and farmers. Thus all interests are represented on the committee. These committees are appointed by the Government for a specified period of time. Important functions performed by the committees can be summarized as follows.
    - Fixation of charges for weighing, brokerages etc.,
    - Prevention of unauthorized deductions, underhand dealings, and wrong practices by the arhatiyas,
    - Enforcing the use of standardized weights,
    - Providing up to date and reliable market information to the farmers, and
    - Settling of disputes among the parties arising out of market operations.
- **Central Warehousing Corporation: -** The Central Warehousing Corporation was set up in 1957 with the purpose of constructing and running godowns and warehouses for the storage of agricultural produce. The states has set-up the State Warehousing Corporations with the same purpose. At present the Food Corporation is constructing its own network of godowns in different parts of the country.
- **Directorate of Marketing and Inspection: -** The directorate was set up by the Government of India to co-ordinate the agricultural marketing of various agencies and to advise the Central and State Governments on the problems of agricultural marketing. Activities of this directorate includes the following:-
    - Promotion of grading and standardization of agricultural and allied commodities;
    - Statutory regulation of markets and market practices;
    - Training of personnel;
    - Market extension;
    - Market research, survey and planning and
    - Administration of old storage order, 1980 and meat food products order, 1973.
- **Government Purchases and Fixation of Support Prices:-** In addition to the measures mentioned above, the Government also announces minimum support price for various agricultural commodities from time to time in a bid to ensure fair returns to the farmers. These prices are fixed in accordance with the recommendations of the Agricultural, Price Commission. If the prices start falling below the declared level (say, as a result of glut in the market), the Government agencies like the Food Corporation of India intervene in the market to make direct purchase from the farmers at the support prices. These purchases are sold off by the Government at reasonable price through the public distribution system.

Problems in Agricultural Marketing

Indian system of agricultural marketing suffers from a number of defects. As a consequence, the Indian farmer is deprived of a fair price for his produce. The main defects of the agricultural marketing system are discussed here:-

- **Improper warehouses: -** There is an absence of proper warehousing facilities in the villages. Therefore, the farmer is compelled to store his products in pits, mud-vessels, "Kutcha" storehouses, etc. These unscientific methods of storing lead to considerable wastage. Approximately 1.5% of the produce gets rotten and becomes unfit for human consumption. Due to this reason supply in the village market

increases substantially and the farmers are not able to get a fair price for their produce. The setting up of Central Warehousing Corporation and State Warehousing Corporation has improved the situation to some extent.

- **Lack of grading and standardization: -** Different varieties of agricultural produce are still not graded properly. The practice usually prevalent is the one known as "dara" sales wherein heap of all qualities of produce are sold in one common lot thus the farmer producing better qualities is not assured of a better price. Hence there is no incentive to use better seeds and produce better varieties.
- **Inadequate transport facilities: -** Transport facilities are highly inadequate in India. Only a small number of villages are joined by railways and pucca roads to mandies. Produce has to be carried on slow moving transport vehicles like bullock carts. Obviously such means of transport cannot be used to carry produce to far-off places and the farmer has to dump his produce in nearby markets even if the price obtained in these markets is considerably low. This is even truer with perishable commodities.
- **Presence of a large number of middlemen: -** The field of agricultural marketing is viewed as a complex process and it involves a large number of intermediaries handling a variety of agricultural commodities, which are characterized by seasonality, bulkiness, perishability, etc. The prevalence of these intermediaries varies with the commodities and the marketing channels of the products. Because of the intervention of many middlemen, the producer's share in consumer's area is reduced.
- **Malpractices in unregulated markets: -** Even now the number of unregulated markets in the country is substantially large. Arhatiyas and brokers, taking advantage of the ignorance, and illiteracy of the farmers, use unfair means to cheat them. The farmers are required to pay arhat (pledging charge) to the arhatiyas, "tulaii" (weight charge) for weighing the produce, "palledari" to unload the bullock-carts and for doing other miscellaneous types of allied works, "garda" for impurities in the produce, and a number of other undefined and unspecified charges. Another malpractice in the mandies relates to the use of wrong weights and measures in the regulated markets. Wrong weights continue to be used in some unregulated markets with the object of cheating the farmers.
- **Inadequate market information: -** It is often not possible for the farmers to obtain information on exact market prices in different markets. So, they accept whatever price the traders offer to them. With a view to tackle this problem the government is using the radio and television media to broadcast market prices regularly. The news papers also keep the farmers posted with the latest changes in prices. However the price quotations are sometimes not reliable and sometimes have a great time-lag. The trader generally offers less than the price quoted by the government news media.
- **Inadequate credit facilities: -** Indian farmer, being poor, tries to sell off the produce immediately after the crop is harvested though prices at that time are very low. The safeguard of the farmer from such "forced sales" is to provide him credit so that he can wait for better times and better prices. Since such credit facilities are not available, the farmers are forced to take loans from money lenders, while agreeing to pledge their produce to them at less than market prices. The co-operative marketing societies have generally catered to the needs of the large farmers and the small farmers are left at the mercy of the money lenders.
- **Small and scattered holding: -** The agricultural holdings are very small and scattered throughout the country, as a result of which the marketable surplus generated is very meagre. It is not an easy task organizing how the goods can be assembled for efficient marketing. Moreover there are many varieties of particular crops and this poses problems in pricing.
- **Forced sales: -** The financial obligations committed during production force farmers to dispose the commodity immediately after the harvest though the prices are very low. Such forced sales or distress sales will keep the farmer in vicious cycle of poverty. Report has it that the farmer, in general, sells his produce at an unfavourable place and at an unfavourable time and usually he gets unfavourable terms.
- **Technological development problems in farm production: -** Evidence has it that technological change in performing certain farm operations brought in new problems in agricultural marketing. For example, paddy harvesters are identified to increase the moisture content problem in paddy; mechanical picking of cotton associated with the problem of mixing trash with cotton; potato diggers are found to cause cuts on the potato; sugarcane harvesters effects the problem of trash mix with the cane, etc. These problems lead to the reduction of price for the farm products. Unless corrective measures are affected, the production technologies accentuate the marketing problems.
- **Poor handling, packing, packaging, and processing facilities: -** For efficient and orderly marketing of agricultural products, careful handling and packing are required. Present packing and handling are inadequate. For instance, many times we see rough and careless treatment in the packing and initial handling of fruits and vegetables. Green vegetables are packed in heavy sacks which will be heated up

quickly at the centre, wilt and rot soon. Workers or passengers are allowed to ride on top of a load of vegetables, which will result in physical damage. Careless handling of fruits and insanitary handling of the produce are other problems. Poor handling and packing expose the products to substantial physical damage and quality deterioration. If there are no processing facilities, say, for tomatoes, it means all the harvested crops must be sold within a given time and because there are packaging problems, quite a substantial part of the produce may be lost before getting to the market. Not only do these losses cut down the supply of products reaching the consumers, but also raise the price of the remaining portion, which must bear all costs.

- **Growth of urban centres: -** The growth of urban centres creates more marketing problems, concerned with inadequate supply to meet the increase in size; the need to create new markets and storage problems.
- **Communication problem: -** One of the key elements of efficient agricultural marketing system is the availability of proper communication infrastructure. Rural areas are inadequately placed with reference to posts, telegraphs and telephone. The literacy rate being low among the farmers, it poses difficulty of the communication tasks.
- **Lack of farmer's organization: -** The farmers are scattered over a wide area without any common organization. In the absence of such organization, farmers do not get anybody to guide them and protect their interests. On the other hand, traders are an organized body. Thus, the marketing system, therefore, constitutes unorganized farming community on one side and organized and powerful traders on the other side. Under such situations, farmers will be generally exploited and do not get remunerative prices for their produce.
- **Inadequate research on marketing: -** Until recently, all efforts have been geared towards producing more without thinking about how to market them. There is need to know about new technologies in food storage and preservation. There is also need for research on consumer demands and preferences, handling and packaging.
- **Problems caused by Globalization: -** The globalization has brought drastic changes in India across all sectors and it is more so on agriculture, farmers and made a deep impact on agricultural marketing. It is basically because of majority of Indians are farmers. It has brought several challenges and threats like uncertainty, turbulence, competitiveness, apart from compelling them to adapt to changes arising out of technologies. If it is the dark cloud there is silver lining like having excellent export opportunities for our agricultural products to the outside world.

Suggestions to Improve Agricultural Marketing

Improving the marketing system of agricultural products would help the farmer to better his economy. The following are suggested measures that could reflect an improved agricultural marketing system:

- **Establishment of More Regulated Markets: -** A regulated market is one, which aims at the elimination of the unhealthy and unscrupulous practices, reducing marketing charges and providing facilities to producers. Under the regulated markets, its management should be vested with market committees in which the members would be producers, traders, officials of the marketing societies, officials of agricultural and animal husbandry etc. The institute should be self-financed, statutory and autonomous. Funds would be raised through licensing fees and market fees on the notified agricultural produce transacted in the premises of the market yard. The regulated market however has the following benefits:
  - Farmers are encouraged to bring their produce directly to the markets.
  - Farmers are protected from the exploitation of market functionaries.
  - Farmers are ensured better prices for their produce.
  - Farmers have access to up-to-date market information.
  - The marketable surplus of the farmers will be increased.
  - Marketing costs are lowered and producers share will be increased.
- **Improvement in Standardization and Grading: -** Standard specifications and grading should be designed to be useful to as many producers, traders and consumers as possible i.e., standards should reflect market needs and wants. One grade should have the same implications to producers, traders and consumers in the quality of the product. It must have mutually acceptable description. They should reflect commodity characteristics that all types of buyers recognize. The grading should be simple, clear and easy to understand.
- **Improvement in Handling and Packing: -** This refers to the adoption of new techniques for the physical

handling of commodities throughout the various phases of marketing, for instance, the use of cold storage (mechanical refrigeration) in handling of perishables, new methods of packing etc. The most appropriate handling and suitable containers among the available ones are meant to use against dust, heat, rain, flies etc., to prevent considerable physical losses and quality deterioration.

- **Provision of Storage Facilities: -** Reduction of physical damage and quality deterioration in the products can be brought about through the application of the scientific techniques and provision of appropriate storage facilities depending on the nature and characteristics of products and the climatic conditions of an area. To this effect, more licensed warehouse are required. A licensed warehouse has the following benefits:
  - Reduces the wastage in storage of various commodities by providing scientific storage facilities
  - Assists the government in orderly marketing of agricultural commodities by introducing standard grade and specifications
  - Issues warehouse receipts, a negotiable instrument in which commercial banks advance finance to the producers and dealers
  - Assists government in the scheme of price support operations.

  However, there would be procedures for storage which are not too bureaucratic. The depositor intending to store the produce in the warehouse would have to present a written requisition in the application prescribed by the warehouse. The commodity meant for storage will be properly packed and delivered at the warehouse. The depositor would have to disclose all details of the commodity including the market value in the application form. The commodity brought for storage will be graded and weighed by trained technical personnel before the commodity can be stored. Different storage charges would also apply for different commodities and the stocks offered for storage will be insured against possible risks of fire, theft and floods, strikes and civil commotion.
- **Improvement in Transport Facilities: -** Link-up and associated road development is sine qua non for the success of market structure. The availability of efficient transportation encourages the farmers to the markets of their option to derive the price benefits. Rural roads particularly are in bad state during all seasons and more so during rainy season. Investment on roads should be given top priority. Also another problem is that perishables cannot be transported in closed wagons hence there is a need to provide necessary ventilation in whichever means they are to be transported.
- **Market Information: -** As such we have newspapers, price bulletins, reports of the government agencies etc., which provide market information. This information would be much more useful if an educational programme is made available to analyse and interpret the information at the markets. The raw data no doubt provides valuable information but skilful interpretation makes it useful to the farmers.
- **Market Research: -** Market research can be defined as the study of consumer demand by a firm so that it may expand its output and market its product. It centres on consumer's needs, preferences, impressions of a product, accessibility of markets, efficiency of marketing etc. Marketing research needs to be given top priority to improve up on the marketing system.
- **Market Extension: -** This involves the dissemination of needed information on marketing to producers. The farmers will be advised on consumer preferences, grading, packaging, transport, etc., in order to help them to secure better returns.
- **Provision of Agricultural Marketing Training to Farmers: -** Provision of training is of utmost importance in view of the malpractices resorted to by various market functionaries. The farmer needs to be trained in product planning i.e. crops and varieties to be grown, preparation of produce of produce for marketing, malpractices and rules and regulations, market information, promotion of group marketing, etc.
- **Promoting Cooperative Marketing: -** Cooperative marketing is the organized sale of farm products on a non-profit basis in the interests of the individual producer. Cooperative marketing are organized by farmers themselves and the profits are distributed among the farmer-members based on the quantity of the produce marketed by them.

  The agricultural marketing system should basically ensure that the producer is encouraged to increase production, besides assuring the farmer remunerative prices for his produce and supplying the commodities to the customers at reasonable prices. In view of this, cooperative marketing societies should be established for meeting the requirements of the farmer. The benefits of cooperative marketing include:
  - Make arrangement for the sale of produce of the members

- Provides credit facilities to the members on the security of agricultural produce
- Provide grading facilities, which would result in better price
- Make arrangement for scientific storage of the member's produce
- Arrange the supply off inputs required by the farmers
- Undertake the system of pooling the produce of the members to enhance the bargaining power through unity of action
- Arrange for the export of the produce to enable the farmers get better returns
- Act as an agent of the government in procurement of food-grains, etc.

- **Provisions for Cold Storage Facilities and Refrigerated Transport: -** For perishable commodities like fruits and vegetables, quality losses are enormous and hence it would be necessary to take measures and devise means or methods of controlling and minimizing losses. Preservation is, thus, a necessary adjunct of production and a vital link between production and consumption. Cold storage is the most important for the proper marketing of horticultural produce, because it had a definite season of production and the quality of the produce deteriorates quickly after harvest. Most fruits and vegetables losses moisture to the surrounding air almost any time in the humidity of the air is less than saturated. It is possible to maintain high humidity of the 80 – 95 per cent in proper cold storages and hence refrigeration is also beneficial in reducing moisture losses. Refrigerated transport for perishables needs to be provided during their movement in marketing channels. Besides road transport, railway wagons should also be suitably modified for transportation of perishables.
- **Development of Physical Market: -** Physical markets handling fruits and vegetables suffer from operational and management inadequacies. A country level plan to identify markets of national importance for fruits and vegetables and provision of need-based infrastructure from export point of view in all these markets is imperative.

Conclusion

There is no doubt that in any marketing there is a motive towards profit involved and at the same time the marketing is to be based on certain values, principles and philosophies such as offering just and fair prices to the farmers who toil hard to till. Bringing necessary reforms coupled with proper price discovery mechanism through regulated market system will help streamline and strengthen the agricultural marketing.

In order to avoid isolation of small-scale farmers from the benefits of agricultural produce they need to be integrated and informed with the market knowledge like fluctuations, demand and supply concepts which are the core of economy. Marketing of agriculture can be made effective if it is looked from the collective and integrative efforts from various quarters by addressing to farmers, middlemen, researchers and administrators. It is high time we brought out significant strategies in agricultural marketing with innovative and creative approaches to bring fruits of labour to the farmers.

Agricultural Transportation: Issues and Related Constraints

Contents

Introduction

An efficient transport system is critically important to efficient agricultural marketing. If transport services are infrequent, of poor quality or are expensive then farmers will be at disadvantage when they attempt to sell their crops. An expensive service will naturally lead to low farm gate prices (the net price the farmer receives from selling his produce). Seasonally impassable roads or slow and infrequent transport services, coupled with poor storage, can lead to losses as certain crops (e.g. milk, fresh vegetables, tea) deteriorate quickly over time. If the journey to market is made over rough roads then other crops (e.g. bananas, mangoes) may also suffer losses from bruising; this will also result in lower prices to the farmer.

Agriculture is best served by consistent high urban, and international, demand. This is best brought about by an efficient, high volume, transport and marketing system where the transporting and marketing unit costs are low. If the margin between what the farmer receives from the sale of his produce and what the urban consumer pays for his produce is high then the effective demand transferred to the farmer will be correspondingly be reduced. Similarly if internal transport costs in a country are particularly high then the scope for agricultural exports will also suffer in comparison with other more efficient countries.

The pattern of agricultural marketing is strongly influenced by the nature of transport services. Many developing countries suffer from monopolistic, low volume and high cost transport and marketing systems. Economies of scale are present in both transport and marketing operations. In the following we will consider transport costs, the impact of roads on rural development, access to markets and the potential use of intermediate means of transport.

Role of Intermediate Means of Transport in Agriculture

Intermediate Means of Transport or IMTs includes wheelbarrows, bicycles, rickshaws, various animal carts and wagons, motorcycles, motorized three-wheelers, and two-wheel tractors that fill the gap between more expensive motor vehicles and tedious human effort. Intermediate means of transport IMTs can play a useful role in agricultural marketing. Walking, the dominant mode of on-farm transport, can restrict any increase in agricultural production. IMT can improve the efficiency of on-farm agricultural transports by reducing transport costs and time. The effects on agricultural production can be manifold:

- Cultivation of bigger areas
- Utilization of more fertile, but remote, soils
- Production of heavier corps
- Increased utilization of fertilizer and manure

- Reduced pest damage and spoilage at crop harvest time
- Reduction of transport time, partly used for income generation
- Reduced effort and drudgery involved in human porterage
- Spill-over effects if animals are used for ploughing and transport

Thus, IMT enable the farmers to respond better to markets by augmenting or changing their production. Additionally, they reduce losses, save transport costs and time. If markets are within walking distance then head loading is important. Transport efficiency can be significantly increased by improvement of footpaths or the use of IMT. If markets are more than half a day's non-motorized travel, a multimodal transport system is a cost-effective solution. Trucks are unbeatable on long distances, good roads and fully loaded, and IMT operate more efficiently on short distances with small loads and on bad roads making a multimodal approach the best solution for rural transport problems.

Effect of Markets and Storage Facilities on Agricultural Transportation

The presence of markets and storage facilities play an important role in affecting choice of vehicle. Markets and storage facilities both provide the same role of acting as a place where agricultural produce can be amalgamated. This may be for the purpose of immediate sale or for transportation to the next destination. Access to markets and storage facilities therefore affect vehicle choice in two main ways.

Firstly, the ease of access to these facilities, whether in terms of distance or ability to use the facilities, will dictate the farmer's decision on which vehicle to use. For example, if the storage facility is close he may decide to buy a non-motorised vehicle which would have been of no use if the facility was beyond a certain distance. Similarly, if once the farmer had reached the facility he was unable to use it either because of its expense or because of exclusionist type practises, the need for a vehicle becomes redundant, and the farmer's produce may as well be sold to the village trader. The farmer will only demand a more advanced vehicle if it is the perception that the vehicle will enable an effective increase in farm gate prices.

Secondly, where goods are amalgamated it means that the density of demand for vehicle services increases. The density of demand is of vital importance in determining vehicle choice. The larger the demand the more an efficient and cost effective vehicle can be justified and hence the unitary costs of transport are reduced. The existence of markets and storage facilities are important at any level. For example, at the village level a small grain store may be able to accumulate enough demand from all the farmers to justify the use of a donkey cart for transportation to market. Without the store individual farmers may only be able to justify head loading their surplus produce to market. Similarly, at the district level a market could attract city traders who bring large trucks to transport the produce bought at the market in bulk.

The ease with which farmers and traders have access to markets and storage facilities will be reflected in their distribution costs (transport and storage). If distribution costs are low this will effectively increase farm gate prices which will give farmers the incentive to increase production.

Transportation Cost of Agricultural Produce and Farmer's Income

Cost of transportation of agricultural produce from the farm sites to the market has a great impact on production and income of farmers. This is because transport charges on agricultural produce vary with type of crops, the efficiency of the transport and distance travelled. A significant proportion of the farmer's income had gone to transportation and this is as a result of bad roads in these areas. High cost of transportation would translate to high selling price and if the price is too high when compared with other farmers from other areas, customers will not buy and this may result to selling at a loss.

The importance of an efficient and competitive marketing system has been stressed as a complement to rural

transport services (RTS) and infrastructure in promoting development. However, the presence of markets in them also constitutes a means by which the effective demand for transport can be increased. A market acts as a point where goods and people are amalgamated together and thereby concentrating the demand for transport. Where populations are dispersed markets are also likely to be dispersed with long average distances to market and people less likely to make the trip. This is an important consideration for the demand for Intermediate means of transports where, if distances become too large, an Intermediate means of transport may not be viable.

In addition, one of the most effective ways that farmers have of getting the best price for their produce is for them to sell it themselves directly to final consumers at rural or urban markets, and thus bypass the normal marketing system. Although farmers do not have the economies of scale of travelling wholesalers it is often recognised by urban dwellers that the keenest prices are often provided by the farmers. Farmers bringing their own produce to market represent a very important way of limiting the power of the marketing cartels. Farmers rely on travelling wholesalers, traders, parastatals or large private marketing companies they all reduce the farmers bargaining power, and critically, it reduces demand for transport services and the supply of vehicles available for rural people. There is usually little support by the authorities for 'unofficial' trading and farmers are frequently harassed as they attempt to sell.

Transportation Problems and Road Network

Farmers face various transportation problems in the process of transporting their produce from the farm to their houses and markets. These problems included:

- Bad roads,
- High cost of transportation,
- Irregularity of vehicles,
- Insufficiency of vehicles,
- Insufficient means of transportation and
- Long distance from farm to their houses as well as markets.

Road network plays main role among them. This is because it is the major means of transporting agricultural produce from the farms to the markets. Road transport has both positive and negative impact on agricultural development in India.

The impacts of bad road infrastructure on agricultural output and productivity are following: -

- The agricultural sector accounts for a large share of gross domestic product. Poverty is concentrated in rural areas. The relatively low levels of road infrastructure and long average travel time's result in high transaction costs for sales of agricultural inputs and outputs, and this limits agricultural productivity and growth.
- Many farmers are reluctant to grow a marketable surplus second crop because it cannot be sold or because the difficulty and expense of transport significantly reduces the returns to labour.
- Agricultural productivity will be low and there is a lack of innovation because extension information and inputs do not reach the farmers.
- Rural people often are too poor to own their own motorized vehicles and depend on public transport to gain access to locations outside their communities. When rural roads deteriorate public transport becomes more expensive and transport operators eventually decide to stop their business.
- Some of the variables that determine the level of development in a given environment are easy accessibility and mobility.
- A strong relationship between road transportation, underdevelopment and rurality has been identified by various researches.
- When the distance of farm to the market is far and the road is rough perishable crops may be destroyed and farmers may run at a loss.

- With improved roads, transport cost savings occur both through lower costs of existing traffic and lower costs of generated and attracted traffic. The assumption is that traffic will grow as a result of road improvements. A deterioration of the road network on the other hand will gradually reduce traffic levels. Moreover the unit transport cost will increase.
- When the roads become impassable, there will be a shift to less-effective modes of transport, replacing motorized transport by more costly non-motorized transport. The move to non-motorised transport often implies that a lot of transport simply ceases to take place. If motorised transport is not available, bulky goods can only be transported for short sections.
- By the reduction in competition in the transport sector due to lower traffic levels, results in the increased cost of transport and that is passed to the farming households.
- A well maintained road network keeps input and transport prices down and, hence, production costs lower and can lead to improved livelihoods through higher incomes.
- The quality and density of the rural road network makes a significant difference in the cost of agricultural inputs, the quality and value of outputs as well as the delivery of extension services.

Problems of Road Transport in India

Road transport of the country is facing a number of problems. Some of these problems are discussed below:

- Most of the Indian roads are unsurfaced (42.65%) and are not suitable for use of vehicular traffic. The poor maintenance of the roads aggravates the problem especially in the rainy season. According to one estimate there is about per year loss of Rs. 200 crores on the wear and tear of the vehicles due to poor quality of roads. Less than 0.1 percent of the national income is spent on the maintenance of roads in India.
- Sixty percent of villages are without roads in India. It adversely affects our agriculture and rural economy.
- There is heavy tax burden on motor transport in India. There are multiple check-posts, toll tax and octoroon duties collection points on the roads which bring down the speed of the traffic and waste time. Rate of road taxes vary from state to state and interstate permits are difficult to obtain.
- Way side amenities like repair shops, first aid centers, telephones, clean toilets, restaurants, rest places are lacking along the Indian roads. There is very little attention on road safety and traffic laws are wilfully violated.
- There is little co-operation and co- ordination among different states with regard to motor transport. As such, motor transport faces lot of difficulties.
- According to 'Road Transport Reorganization Committee', 90 per cent of the operators are small operators owning five vehicles or less. Owing to this small number, satisfactory and efficient service is not being provided to the people.
- Due to high prices of petroleum products and diesel operational costs of road transport are rising and making the mode of transport more costly.
- Most of the drivers on the roads are unskilled and untrained.
- One major problem on the Indian roads is the mixing of traffic. Same road is used by high speed cars, trucks, two wheelers, tractors, animal driven carts, cyclists and even by animals. Even highways are not free from this malady. This increases traffic time, congestion and pollution and road accidents.
- In India, roads are not well-maintained as there are no timely repairs. It causes discomfort and quick depreciation of vehicles.
- There is very little participation of private sector in road development in India because of long gestation period and low-returns. The legislative framework for private investment in roads is also not satisfactory. The road engineering and construction are yet to gear themselves up to meet the challenges of the future.
- There has been no stability in policy relating to highway development in the country. It has changed with the change of government. There are a number of agencies which look after the construction and maintenance of different types of roads. Since there is no co-ordination between these agencies their decisions are often conflicting and contradictory.

Special Problems in the Construction of Rural Roads

Rural roads constitute a special category of roads as regards the type of materials used and construction techniques employed, as compared with roads forming the highway network. As a result, the construction and maintenance problems involved in keeping the rural road network at a satisfactory level of serviceability are of a different quantum and type. Some of these problems are:-

- Rural roads are generally built up in stages, extending over a number of years. This practice arises from the inadequate availability of finances, as well as from the fact that the traffic is likely to increase after an initial road link is established, thereby necessitating an upgradation of the pavement.
- One important and significant feature pertaining to the construction of rural roads is the emphasis placed on the utilisation of the local materials, both soil and stone aggregates in the various layers of the pavement. This necessitates that such materials to be utilized after careful evaluation of their properties and affecting the needed improvements by blending or the use of additives as may be required.
- The construction of rural roads is handled by a number of different agencies, varying from state to state. Within the same state different agencies might be building rural roads in different districts.
- The level of expertise available shows great variation from department to department, and it is not unusual to find that trained personnel are not available in the executing department to plan, design and construct a rural road that makes optimal use of the material and financial resources available and build a material and financial resources available manual labour is resorted to, to the maximum extent, since providing employment to the local population also forms one of the essential objectives of the various rural development programmes.
- Rural labour generally does not have the necessary skills associated with the different phases of road construction, nor is any training imparted to them before inducting them into the construction programme. Employment on such construction works is viewed, rather mistakenly, as a relief measure lesson the problem of rural employment. The consequence of such thinking is a finished product of poor quality, i.e., an improperly built road that has only frittered away the meagre resources.
- The lack of adequate quality in the inputs, human as well as material, results in a faster deterioration of the serviceability to a lower than the tolerable level. In turn, these results in greater demands on maintenance, viz, more frequent repairs, involving additional deployment of manpower and materials, all adding upto higher spending on maintenance. If money for maintenance is short, final result will be the deterioration of the roadway leading to the loss of initial capital investment itself.

Measures Taken for Improving Rural Road Infrastructure by Government

Rural roads connect villages giving access to rural population to the National Highways through Major District Roads and State Highways. Around 59 per cent of the total road length is accounted by rural roads largely built under Jawahar Rojgar Yojna. These roads are of limited value from the point of view of movement of heavy traffic. Some of the government's measures to improve rural road infrastructure are as follows:-

- Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched on 25th December 2000 as a fully funded Centrally Sponsored Scheme to provide all weather road connectivity in rural areas of the country. The programme envisages connecting all habitations with a population of 500 persons and above in the plain areas and 250 persons and above in hill States, the tribal and the desert areas.
- The District Rural Roads Plans (DRRPs) have been developed for all the districts of the country and Core Network has been drawn out of the DRRP to provide for at least a single connectivity to every target habitation. This planning exercise has been carried out with full involvement of the three tier Panchayati Raj Institutions.
- Large scale revision of Rural Roads Manual were carried out by IRC at the special intervention of Ministry of Rural Development. This Manual has established the standards for construction of Rural Roads.

- A three tier quality mechanism has been operationalised to ensure quality of road works during construction.
- There is a provision of two bills of quantities, one for construction and another for routine maintenance on lump-sum basis amount every year for 5 years and the contactor is required to offer not only for construction but also for maintenance separately. This helps in delivery of better quality roads because if the quality of road is compromised by the contractor during construction, much more money would be required during the routine maintenance rendering the contract uneconomical for the contractor.
- A web based online monitoring, management and accounting system has been developed under the PMGSY. The online system and website is being managed and maintained in collaboration with NIC and CDAC.
- The Central Government has created a dedicated fund, called Central Road Fund through collection of cess from petrol and diesel. Presently, Rs. 2/- per litre is collected as cess on petrol and High Speed Diesel (HSD) Oil. The fund is distributed for development and maintenance of National Highways, State Roads and Rural Roads.
- Special construction technology to tackle the construction of roads in the hilly regions would be adopted to ensure quality roads within a specific time frame.
- Promoting participation of private operators on non viable semi urban/rural routes through favourable policy regime. This could be achieved through following options:-
    - Auctioning of combination of routes (which are a mix of profitable and non viable routes) to private operator(s) so as to enable them to compensate their losses on account of operation of non viable routes;
    - Offering non viable routes to bidder asking for lowest subsidy/financial support;
    - Subjecting non viable routes to lower rates of taxation or permit fees and;
    - Allowing alternate competing modes of passenger road transport.

Suggestions for Better Rural Road Network

It is essential that for quick development of rural road network concerted effort is required during planning which should begin at gross root level by associating the concerned village folk and by convincing them that appropriate quality of road constructed with appropriate technology would meet their requirement and this would be maintained and upgraded with their association. All possible resources should be mobilized for raising the necessary funds. Some of the possible suggestions are:-

- A feeling has to be created in rural people that they are getting or building an asset for themselves and future generation instead of having a feeling that government is building a road and that the major beneficiaries are the government agencies or the contractor. In other words they should have feeling of belonging instead of detachment.
- If Villagers are made aware about their minimum needs and assured that all assistance will be forthcoming for proper maintenance and continuous upgrading of the road with time and need, they will have a cooperative attitude and would assist in many ways during the initial construction, or subsequent maintenance.
- Land consolidation work can be taken up simultaneously to planning. The land for access road along with raising of the track and proper drainage of the village should also be considered with other facilities for the village during land consolidation. The land for access road on embankment may be considered similar to land reserved for Panchayat land and other common facilities to the village.
- In some cases the village get submerged by the flood of a nearby river. In that case protection of village by bunds/dykes can be considered and these “bunds” will also provide access roads on embankment. But the drainage of village has to be adequately planned in these cases otherwise any opening in the ‘bund’ for cross drainage works, may flood the village by back flow when water level is higher on the other side.

- The quality of road to be constructed has to be planned and will depend upon the subgrade soil properties, level of water table, quantity and quality of anticipated traffic and level of maintenance to be provided. The simplest and first stage of road construction is a properly cambered formation, with reasonable shoulder width and drainage system.
- The road construction work can be taken up in lean farming period, where by free (if managed) or cheap labour could be available. Similarly the timely maintenance of rural roads is essential. This is from the consideration that once damage starts in rural earthen roads it will develop at a much faster pace compared to higher grade roads. Any neglect will totally undo the assets created in past and instead of upgrading at a later date, only in first stage construction has to be repeated every time afresh. The standard of road should be continuously raised and adequately maintained over the future years.
- At least some part of land revenue collected from the villages could be ploughed back for their development and a minimum percentage of land revenue should be earmarked for rural roads also.
- Another source of raising fund for the rural road development could be, levying a sort of a cess on the saleable produce. This could be collected from the farmers at the market place, sugar mills, rice mills, etc. Many market places (Mandies) do levy a cess on the parked vehicles and produce sold, for the development of market place and for the facilities provided. Even the private wholesale dealers charge commission over the sale. At present most to the farm produce is purchased by the governmental agencies and the price offered s according to the rates fixed by the government, thus the cess to be collected may form a part of the price offered. The cess collected from market place may be distributed amongst the villages feeding the market place.
- Village Panchayats can also collect a type of 'Road Tax' from the vehicles in the village. The rates could be different for different types of vehicles.
- A toll tax can be collected by panchayat from the vehicles visiting the village.
- Banks can also be asked to liberalize their policy and should consider advancing loans to villages at nominal interest for construction of rural roads providing access to the village which would not involve greater risks than that of existing procedure of advancing loans to artisans, etc. for setting up their shop, workshop etc. for increasing the income.
- Industrial houses, commercial undertakings, banks etc. can also be asked to adopt villages for upliftment. Villages selected should be similar to selection of poor families in a village or district for their upliftment. These families are given some fund for raising their means of livelihood.
- The government can also provide matching grant to the funds raised by Panchayat by tax collection, donation, etc. for access road construction to backward villages.
- By proper training and motivation of the personnel involved in the construction and maintenance of these, as well as increasingly adopting appropriate technological methods that have been developed, better rural roads can be built.

Conclusion

Transport plays a significant role in the structure of food production and marketing and that easy transport to market can make all the difference in the level of rural incomes. An improved transportation will encourage farmers to work harder in the rural areas for increased production, add value to their products, reduce spoilage and wastage, empower the farmers as well as having positive impact on the productivity, income, employment level and reduce poverty level in the rural areas. Finally, transport is also seen as a facilitating factor in the mobilisation of the farmers and other allied workers in the overall national development of the nations.

e-Agriculture : e-Technology in The Aid of Farmers

Contents

Introduction

E-Agriculture is an emerging field for enhancing sustainable agriculture and food security through improved processes for knowledge access and exchange using information and communication technologies (ICT).

Agriculture is one of the most important sectors in India, and could benefit tremendously with the applications of ICTs especially in bringing changes to socio-economic conditions of poor in backward areas. Agriculture constitutes a major livelihoods sector and most of the rural poor depend on rain-fed agriculture and fragile forests for their livelihoods. Farmers in rural areas have to deal with failed crops and animal illness frequently and due to limited communication facilities, solutions to their problems remain out of reach.

The service role of ICTs can enhance rural community's opportunities by improving their access to market information and lower transaction costs for poor farmers and traders. Though India has a strong and fast growing IT industry, access to ICTs remains very low particularly in rural areas. The present indicators of IT penetration in Indian society are far from satisfactory.

The National Policy for Farmers emphasizes the use of Information and Communication Technology (ICT) at village level for reaching out to the farmers with the correct advisories and requisite information. The available satellite data relating to weather news, long-term and short-term weather forecast, production information, market prices policy developments pertaining to agriculture, apart from the number of advisory services in public or private domain that disseminate information should be utilized adequately.

Information Technology and its Components

Induction of IT as a strategic tool for agricultural development and welfare of rural India requires that the necessary IT infrastructure is in place. The rapid changes and downward trend in prices in various components of IT makes it feasible to target at a large scale IT penetration into rural India. Some of the broad factors to be noted with respect to various components of IT are listed below:

- **Input Devices:** Radical improvements are witnessed with respect to the means of communication by human beings with computers such as key boards, mouse devices, scanners. The advent of touch screen monitors that allow users to give input to computers by touching on the appropriate location of the monitor has made it possible to develop user-friendly interface for farmers which is easy, intuitive, circumvents language barrier and at the same time provides a relaxed environment to the users. The present day digital cameras make it possible to capture and store good quality graphics and large video clips. The small size and low weight of these digital cameras, which are increasingly becoming affordable, open up the possibilities of providing computer based demonstration clips to educate the farmers. The digital cameras can also be used to upload plant stress related images, movie clips which can facilitate an expert residing at a far of location to quickly recommend a solution.
- **Output Devices:** Monitor screens, printers & plotters, data projectors support high resolution and good quality output. The qualities of these output devices have the potential of generating renewed interest in the farmers in using IT based services. The light weight portable data projectors can be easily carried by the agricultural extension personnel for serving larger audience. Similarly, speakers can also be attached to the computers to incorporate voice based trainings for farmers.
- **Processors:** The processing speeds of computers have gone up. At present high speed processorsare available which makes it possible to undertake substantial processing of data at the client side.
- **Storage Devices:** 80GB and even higher hard disk drives have become common in PC range of computers. This makes it possible to store substantial information at the local level which facilitates faster access. Similarly, high capacity pen drives, CDs make it possible to transfer large volumes of data to locations which cannot be connected to networks immediately. These storage devices are also used for backup of crucial data. As a precaution, many corporate store their backups at locations away from the place of work.
- **Software:** Various operating systems are available which act as interface between the user and the machine. The graphic user interface (GUI) has become an accepted prerequisite for end users. Application software which can support complex user requirements are available. Of the shelf solutions for office automation packages, groupware applications, complex database solutions, communication products, solutions based on remote sensing & geographical information systems are available. In addition, solutions based on some or all of these are also readily available. The present downward trend in the IT industry provides an opportunity get customised application for any specific task developed at an affordable price. Rapid Application Development and Deployment (RADD) is a popular model for quick development and deployment of applications. Development environment itself is simplified with tools that quicken the pace of software specialists. Project management and monitoring software are available that facilitate efficient execution of large and complex applications that are required for rural India.
- **Networking Devices:** The capacity of modems, used to convert the data from digital to analog and vice versa, which are popularly employed to use telephone lines have increased. Internal modems are available integrated into the computer so that they are not exposed to outside environment. The capacities of other networking devices such as routers have also gone up which makes it possible to create large networks with smooth data transmission.
- **Transmission Media:** The media through which the data transfer takes place has also undergone revolutionary change. Telephone lines are still the popular source in India although the reliability and low bandwidth are still major issues. High capacity cables, optical fibre, radio, wireless local loops, satellite transmission and various solutions based on a combination of these are already being used in many parts of the country.
- **Other Accessories:** Uninterrupted Power Supply (UPS) devices are crucial to ensure the durability of the IT equipment as well as provide backup mechanisms. The potential of solar power packs to provide a feasible solution to shortage of power in the rural areas needs to be exploited.

Role of IT in Agriculture

Applications of IT in support of agricultural and rural development fall into five main areas. These are:

- Economic development of agricultural producers;
- Community development;
- Research and education;
- Small and medium enterprises development; and
- Media networks.

Precision farming, popular in developed countries, extensively uses IT to make direct contribution to agricultural productivity. The techniques of remote sensing using satellite technologies, geographical information systems, agronomy and soil sciences are used to increase the agricultural output. This approach is capital intensive and useful where large tracts of land are involved. Consequently it is more suitable for farming taken up on corporate lines.

The indirect benefits of IT in empowering Indian farmer are significant and remain to be exploited. The Indian farmer urgently requires timely and reliable sources of information inputs for taking decisions. At present, the farmer depends on trickling down of decision inputs from conventional sources which are slow and unreliable. The changing environment faced by Indian farmers makes information not merely useful, but necessary to remain competitive.

Here are some agricultural development services that can be provided in the developing world using ICT:

- Online services for information, education and training, monitoring and consultation, diagnosis and monitoring, and transaction and processing;
- E-commerce for direct linkages between local producers, traders, retailers and suppliers;
- The facilitation of interaction among researchers, extension (knowledge) workers, and farmers;
- Question-and-answer services where experts respond to queries on specialised subjects ICT services to block- and district-level developmental officials for greater efficiency in delivering services for overall agricultural development;
- Up-to-date information, supplied to farmers as early as possible, about subjects such as packages of practices, market information, weather forecasting, input supplies, credit availability, etc.;
- Creation of databases with details of the resources of local villages and villagers, site-specific Information systems, expert systems, etc.;
- Provision of early warning systems about disease/ pest problems, information regarding rural development programmes and crop insurances, postharvest technology, etc.;
- Facilitation of land records and online registration services;
- Improved marketing of milk and milk products;
- Services providing information to farmers regarding farm business and management;
- Increased efficiency and productivity of cooperative societies through the computer communication network and the latest database technology;
- Tele-education for farmers;
- Websites established by agricultural research institutes, making the latest information available to extension (knowledge) workers and obtaining their feedback.

E-Agriculture Ecosystem

E-Agriculture initiatives bring together a wide array of local and regional stakeholders to form a mutually beneficial value chain:-

- **Grameen Intel and other social businesses:** Information and expertise, consulting services, technology, and programs to reach rural and impoverished markets.
- **Governments and multilateral development agencies:** Program support to enable and increase rural outreach, improve food security, create jobs, and develop partner-ships with local businesses and community organizations.
- **Banks and other financial institutions:** Credit, capital, and other financial instruments (crop insurance, subsidies, etc.) for entrepreneurs and farmers.
- **Universities and agriculture extension systems:** Technology to strengthen extension systems; advice and technical support for farming communities; training and capacity-building for entrepreneurs; research and development projects designed to solve problems faced by farming communities.
- **Supply chain (e.g., suppliers, commodity markets, aggregators):** Best-of-class products and services for farmers that improve returns to all stakeholders, including farmers.
- **Technology companies:** Internet connectivity, hardware, and software solutions that create access to new markets, value chains, and business models.
- **Community organizations (e.g., farmer cooperatives, rural telecenters, government and NGO-run agriculture service centers):** Help entrepreneurs; provide grassroots agriculture domain and business support, and enable programs to scale efficiently.

ICT Initiatives for Agricultural Development in India by Various Agencies

Some initiatives in India that use ICT for agricultural development are:

- Gyandoot project (Madhya Pradesh);
- Warana Wired Village project (Maharashtra);

- Information Village project of the M S Swaminathan Research Foundation (MSSRF) (Pondicherry);
- iKisan project of the Nagarjuna group of companies (Andhra Pradesh);
- Automated Milk Collection Centres of Amul dairy cooperatives (Gujarat);
- Land Record Computerisation (Bhoomi) (Karnataka);
- Computer-Aided Online Registration Department (Andhra Pradesh);
- Online Marketing and CAD in Northern Karnataka (Karnataka);
- Knowledge Network for Grass Root Innovations-Society for Research and Initiatives (SRISTI) (Gujarat);
- Application of Satellite Communication for Training Field Extension Workers in Rural Areas (Indian Space Research Organisation);

In addition to the above, a few non-governmental organisations (NGOs) have initiated ICT projects such as:

- Tarahaat.com by Development Alternatives (Uttar Pradesh and Punjab);
- Mahitiz-samuha (Karnataka);
- VOICES – Madhyam Communications (Karnataka);
- Centre for Alternative Agriculture Media (CAAM);

Some exclusive agricultural portals are also available, such as:

- haritgyan.com
- krishiworld.net
- toeholdindia.com
- agriwatch.com
- itc's soyachoupal.com
- acquachoupal.com
- plantersnet.com

Case Studies

These are some of the few examples of ICT enabled services for Indian farmers:-

Agropedia

- Agropedia is a peer-group tool for interaction among the farmers.
- This is a comprehensive, integrated model for digitalized content of agricultural domain. This e-initiative intends to bring together a community through ICT enabled knowledge creating and organising platform with an attempt to leverage the current agricultural extension system.
- IIT Kanpur (agropedia platform), IIT Bombay and IIITM Kerala (multi-model delivery) are the three key partner organizations who are in charge of different projects and responsibilities along with ICRISAT- Hyderabad, NAARM- Hyderabad, GBPUAT- Pantnagar, UAS- Raichur under the aegis of the National Agricultural Innovation Project (NAIP).
- ICRISAT is the consortium leader, which is responsible for the outputs and deliverables.
- Agropedia has been labelled as one stop solution for the Indian agro-sphere. Defining and developing the Knowledge-Model for understanding of the crop has been done first time ever in the world in order to accumulate codified and approved information about the crops with the support of Food and Agriculture Organisation (FAO), Rome.
- These models are essentially the structural representation by using symbols for tagging a particular piece of information and relationships between them. Following this, Chickpea, Pigeon pea, Sorghum and Groundnut.
- Knowledge-Models are developed at ICRISAT, Wheat, Sugarcane, Litchi and Vegetable pea are developed at GBPUAT and Rice is developed at IITK.

e-Choupal

- e-Choupal is an initiative from ITC's Agri Business Division to face the challenges of India's agricultural uncertainty.
- Indian agriculture is characterised by fragmented farms, weak infrastructure and the involvement of numerous intermediaries. e-Choupal aims at bringing out the Indian farmers from vicious circle of low risk taking ability.
- To increase the competitiveness of the Indian agricultural sector and enhance productivity, ITC has developed this market-led business model. It is assumed and expected that a growth in rural incomes will also result in the overall growth of Indian economy.
- e-Choupal operates in three layers. This three-layered infrastructure allows ITC to provide a complete end-to-end solution to suit the needs of both the farmers and consumers at village as well as in global level.

- The first layer consists of ICT kiosks (Village Level) with internet access, managed by an ITC trained local farmer called the Sancalak. The second layer is known as hubs managed by the traditional intermediary who has local knowledge /skills called Samyojak. The final layer is a network of companies (consumers of farmers products and providers of products and services to the farmers) orchestrated by ITC is known as Choupal Sagar, which has a pan-Indian presence.
- With this model, ITC is able to deliver the same benefits as vertical integration does in matured agricultural economies like USA.
- e-Choupal is the largest initiative among all Internet-based programmes in rural India. It reaches to over 4 million farmers of more than 400000 villages through 6500 kiosks. It operates across ten states, namely Madhya Pradesh, Haryana, Uttarakhand, Karnataka, Andhra Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Kerala and Tamil Nadu in the cultivation of soybeans, coffee, wheat, rice, pulses, and shrimp.

Kissan Kerala

- Kissan Kerala is an Agriculture Information Services system to provide information and advisory to the farmers of Kerala. This is accessible by all concerned anytime in the day and from any parts of the state.
- The objective of this programme is to empower the farmers by providing them useful information and required knowledge; this would lead the farmers to take better decision.
- To disseminate the message and to answer farmer's queries, various channels are used like Television, Internet, Telephone, and Mobile. The farmers are free to choose any medium of their choice.
- The quintessential feature of this ICT enabled service delivery model is to ensure that the farmers get the expert's assistance on time and agricultural organisations provide necessary help to the farmers.
- This has helped the cultivators to better the crop production, enhanced crop protection, value addition to the existing practices, opening up new avenues and improves the overall life of the farming community.
- Children, Youth, women, men and seniors are the target group of this programme, who are somewhat related to the agricultural activities.
- Kissan Kerala focuses on five broad areas.
    - Online Agri advisory service : Portal based online Advisory services for the farmers (www.kissankerala.net)
    - Kissan Krishideepam : Agriculture based weekly Television program in vernacular language
    - Online Agri video Channel : In collaboration with the You Tube, online agricultural video channel was brought in the country
    - Tele Advisory Services : Farmers are just a call away from getting solutions to their problems. AQ dedicated phone number is there to address their need
    - The mobile based Agri Advisory services: Through text, voice or video message, farmers can get their answers on mobile phones

AgmarkNet

- In order to bring the farmers in a better bargaining position and to promote a culture of good agricultural marketing practices in the country, Directorate of Marketing and Inspection (DMI) , Ministry of Agriculture has embarked upon an ICT Project – NICNET based Agricultural Marketing Information System Network (AGMARKNET) as part of the Central Sector Scheme : "Marketing Research and Information Network".
- Objectives:
    - To establish a nation-wide information network for speedy collection and dissemination of market information and data for its efficient and timely utilization.
    - To facilitate collection and dissemination of information related to better price realization by the farmers by facilitating:
        - Market related information such as market fee, market charges, costs, method of sale, payment, weighment, handling, market functionaries, development programmes, market laws, dispute settlement mechanism, composition of Market Committees, income and expenditure, etc.;
        - Price-related information such as minimum, maximum and modal prices of varieties and qualities transacted, total arrivals and dispatches with destination, marketing costs and margins, etc.;
        - Infrastructure related information comprising facilities and services available to the farmers with regard to storage and warehousing, cold storage, direct markets, contract farming, buy-back arrangements, grading, re-handling and repacking etc.;
        - Promotion related information covering accepted standards and grades, labelling, sanitary and phyto-sanitary requirements, pledge finance, marketing credit and new opportunities available in respect of better marketing;

- To sensitize and orient farmers to respond to new challenges in agricultural marketing by using ICT as a vehicle of extension.
- To improve efficiency in agricultural marketing through regular training and extension for reaching region-specific farmers in their own language.
- To provide assistance for marketing research to generate marketing information for its dissemination to farmers and other marketing functionaries at grass-root level to create an ambience of good marketing practices in the country.

- Under the project, 199 market nodes are computerized and are reporting daily prices of commodities reaching these markets noted. The training to the officials of the department has been conducted.

eMojani

- eMojani is a software to distributed to land and city survey offices.
- One can now apply online for his request for measuring his land. All Fees are calculated and displayed by the application.
- The application allocates the cases to registered Measurement Surveyors of the department. Now the system decides the Surveyors for doing the measurement and not the individual from the department.
- The application generates the necessary Challan's, Receipts and prints the Date of Measurement, Name of Surveyors for doing the measurement along with their contact details.
- This application has been implemented throughout the state. Department has banned the manual maintenance of Measurement case register. Manual applications are no more accepted.
- The manual calculation of the fees and assigning the cases to the individual Surveyors has been stopped.
- The eMojani Application is Integrated with Govt. Receipts and Accounts System (GRAS) for on line transfer and accounting of citizen payments towards various fees. The application has been awarded with the "eGovernance Public Jury Award by the State Government" for the year 2012.

Agri - Subsidy

- An online application that automates the subsidy distribution operation under various schemes of Agriculture department.
- The application is entered online from block level, forwarded to district office Online & the same is sanctioned at District level Online.
- While sanctioning the subsidy, it is taken care that necessary funds are available at district office that was allocated from state level office.
- The subsidies are granted for 11 different schemes of central & state.
- The details of payment of subsidy are also entered online & SMS is sent to the farmer on every event of his application. Various kinds of reports are available for monitoring and evaluation of the project.

Kisan Call Centers

- The Kisan Call Centre (KCC) initiative aims to provide information to the farming community through toll-free telephone lines.
- Under this project, call centre facilities have been extended to the farmers through call centres located in different states so that farmers can get the information in their own language.
- Recently KCCs have been further revamped by consolidation and appointing a new service provider for KCC to set up state of the art KCCs at 14 identified locations.

National e-Governance Plan in Agriculture (NeGP-A)

- The Mission Mode Project has been introduced during last phase of the 11th plan to achieve rapid development of agriculture in India through the use of ICT for ensuring timely access to agriculture related information for the farmers of the country.
- There are a number of current IT initiatives/schemes undertaken or implemented by DAC which are aimed at providing information to the farmers on various activities in the agriculture value chain.
- These initiatives will be integrated so that farmers would be able to make proper and timely use of the available information.
- Such information is intended to be provided to farmers through multiple channels including Common Service Centers, Internet Kiosks and SMSs. 12 clusters of services have been identified and the project has been sanctioned for implementation in 7 States i.e. Assam, Himachal Pradesh, Karnataka, Jharkhand, Kerala, Madhya Pradesh and Maharashtra.
- The services include Information on Pesticides, Fertilizers & Seeds, Soil Health; Information on crops, farm machinery, training and Good Agricultural Practices (GAPs); Weather advisories; Information on prices, arrivals,

procurement points, and providing interaction platform; Electronic certification for exports & import; Information on marketing infrastructure; Monitoring implementation / evaluation of schemes & program; Information on fishery inputs; Information on irrigation infrastructure; Drought Relief and Management; Livestock Management.

Bhoomi

- The land records management system is the first e-Governance project successfully implemented for the benefits of the common man, jointly by the Government of Karnataka & NIC Karnataka.
- It has been providing service to more than 70 lakh farmers of Karnataka since the last five years.
- BHOOMI has become the model for replication in many other States. It has received wide spread recognition from the public and also won the international award, Silver of CAPAM 2002.
- Salient features are Kiosk setup in each taluk to issue the land records documents to public on demand, Finger print (Bio-metrics) authentication to ensure fool proof system, PKI enabled BHOOMI & integration with Sub-Registrar's data, Mutation requests processed on First-in First-out Basis.

TARAhaat

- This project, named "TARAhaat" after the all-purpose haat (meaning a village bazaar), comprises a commercially viable model for bringing relevant information, products and services via the Internet to the unserved rural market of India from which an estimated 50% of the national income is derived.
- TARAhaat combines a mother portal, TARAhaat.com, supported by franchised networks of village cybercafes and delivery systems to provide a full range of services its clients.

Warana Wired Villages

- The key objective of the project has been to utilise IT to increase the efficiency and productivity of the existing sugar cane cooperative enterprises by setting up of a state-of-the-art computer communications network.
- This provides agricultural, medical, and educational information in the local language to villages around Warana Nagar in the Kolhapur and Sangli Districts of Maharashtra.

Dairy Information Services Kiosk

- The DISK application targeted at the booming dairy sector has been tested for two milk collection societies by the Indian Institute of Management Ahmedabad's e-governance center.
- The project consists of two basic components—an application running at the rural milk collection society that could be provided Internet connectivity and a portal at the district level serving transactional and information needs of all members.
- DISK has helped in the automation of the milk buying process at 2,500 rural milk collection societies and has been tested in two co-operative villages of Amul dairy in Kheda district.
- Software called AkashGanga has been developed with special features to enable speedier collection of milk and faster disbursement of payments to dairy farmers.

GramSampark

- 'Gramsampark' is a flagship ICT product of the state of Madhya Pradesh.
- A complete database of available resources, basic amenities, beneficiaries of government programmes and public grievances in all the
- 51,000 villages of Madhya Pradesh can be obtained by accessing the website.
- Gramsampark has three sections-Gram Paridrashya (village scenario), Samasya Nivaran (grievance redress) and Gram Prahari (village sentinel). An eleven-point monitoring system has been put in place whereby programmes are monitored village-wise every month.
- Four more programmes are under the monitoring system, which includes untouchability-eradication, women's empowerment, water conservation and campaigns for sanitation.

Digital Gangetic Plane

- One of the first few long-distance Wi-Fi projects in the world, the Digital Gangetic Plane (DGP) connects few villages in Uttar Pradesh to internet using wireless network.
- Media Lab Asia (MLA) and Indian Institute of Technology (IIT), Kanpur started creating the DGP wireless network.
- The even terrain of Gangectic plain allows unhindered line-of-sight signal transmission for wireless networks despite the presence of tall telecom or power supply towers.
- Applications developed intervene on education, health and livelihoods.
- Bimari Jankari or disease information portal offers healthcare information in Hindi.
- Digital Mandiis a one-stop agro-commodities prices shop for rural farming communities.

- The portal serves as agricultural knowledge base in Hindi.
- DGP is largely limited by its approach of being a technological research focused on innovation, experimentation and deployment of Wi-Fi enabled internet connectivity.

Gyandoot

- Gyandoot is a rural infokiosk-based e-governance service delivery model initiated by the state government of Madhya Pradesh in Dhar district.
- The project aims to create a cost-effective, sustainable and replicable rural internet delivery model for improving government services for the poor, involving citizen's cooperatives, government and the community.

IT and Indian Agriculture in the Future

Technologically it is possible to develop suitable systems, as outlined in the previous sections, to cater to the information needs of Indian farmer. User friendly systems, particularly with content in local languages, can generate interest in the farmers and others working at the grassroots. It is possible to create dedicated networks or harnesses the powers of Internet to make these services are available to all parts of the country.

The task of creating application packages and databases to cater to complete spectrum of Indian agriculture is a giant task. The Long Term Agriculture Policy provides an exhaustive list of all the areas that are to be covered. This can be taken as a guiding list to evolve design and develop suitable systems catering to each of the specified areas. Our country has the advantage of having a large number of specialised institutions in place catering to various aspects of Indian agriculture. These institutions can play a crucial role in designing the necessary applications & databases and services. This will facilitate modularisation of the task, better control and help in achieving quick results. As it is, several institutions have already developed systems related to their area of specialisation. For quick results, it may be useful to get the applications outsourced to software companies in India. This will facilitate quick deployment of applications and provide boost to the software industry in India. In order to avoid duplication of efforts, it may be useful to consider promoting a coordinating agency which will have an advisory role to play in evolving standard interface for users, broad design and monitoring of the progress.

In the post WTO regime, it is suggested that it is useful to focus more on some agricultural products to maintain an unquestionable competitive advantage for exports. This will call for urgent measures to introduce state of the art technologies such as remote sensing, geographical information systems (GIS), bio-engineering, etc. India has made rapid strides in satellite technologies. It is possible to effectively monitor agricultural performance using remote sensing and GIS applications. This will not only help in planning, advising and monitoring the status of the crops but also will help in responding quickly to crop stress conditions and natural calamities. Challenges of crop stress, soil problems, natural disasters can be tackled effectively through these technologies. A beginning in precision farming can be encouraged in larger tracts of land in which export potential can be tilted in our country's favour.

While developing these systems it is necessary to appreciate that major audience that is targeted is not comfortable with computers. This places premium on user friendliness and it may be useful to consider touch screen technologies to improve user comfort levels. It is often observed that touch screen kiosks, with their intuitive approach, provide a means for quick learning and higher participation. It is also necessary to provide as much content as possible in local languages.

Once the required application packages & databases are in place, a major challenge is with respect to dissemination of the information. The Krishi Vigyan Kendras, NGOs and cooperative societies may be used to set up information kiosks. Private enterprise is also required to be drawn into these activities. These kiosks should provide information on other areas of interest such as education, information for which people have to travel distances such as those related to the government, courts, etc. Facilities for email, raising queries to experts, uploading digital clips to draw the attention of experts to location specific problems can be envisaged.

Constraints and Remedies for Effective Dissemination

Educating and catering to the information needs of farmers across nearly seven lakh villages in India indeed sounds unrealistic as this would require immense financial investment. A one-time major investment in establishing communication technologies in the required places restricts the government's objective of covering more people regularly because of insufficient power availability in rural areas, poor ICT infrastructure, ICT illiteracy, non availability of timely relevant content, non-integration of services, poor advisory services and lack of localization, and in particular non availability of agricultural information kiosks/ knowledge centers at the grass root level.
Some of the major constraints delaying the spread of e-revolution to rural India are listed below:

- **Haphazard development:** It is observed that some initiatives have already been made to provide IT based services to rural community. However, duplication of efforts are witnessed as most of the services revolve around limited subjects. Keeping in view the giant task involved, it is necessary to form a coordination mechanism to strive for a

concerted effort to support farming community in the country. Such a coordination agency may only have advisory powers such as user interface, broad design, delivery mechanism of the content and standards for setting up kiosks.

- **User friendliness:** The success of this strategy depends on the ease with which rural population can use the content. This will require intuitive graphics based presentation. Touch screen kiosks are required to be set up to encourage greater participation.
- **Awareness about the Benefits of ICT:** Farmers sometimes become averse to adopting technology as they think that it might result in their losing their traditional methods of cropping practices. They simply do not want to use such systems, even if the cost incurred is negligible. Therefore, the attitude and mindset of farmers needs to be changed first. There is a need to win their confidence and create awareness about the benefits of ICT in agriculture.
- **Local languages:** Regional language fonts and mechanisms for synchronisation of the content provides a challenge that needs to be met with careful planning.
- **Restrictions:** Information content based on remote sensing and geographical information systems can provide timely alerts to the farmers and also improve the efficiency of administration. These applications can have a major impact on the farmers and help them to appreciate the potential of information technology. However, government's map restriction policies often threaten to stifle the optimal utilisation of these tools.
- **Power Supply:** In most of the rural India, power supply is not available for long hours. This will reduce the usefulness of the intended services. Since almost entire country receives sunshine for most part of the year, it is useful to explore solar power packs for UPS as well as for supply of power. The Ministry of Non-conventional Energy Sources may pay special attention in this area which can be a major contributor to the growth of IT in villages.
- **Connectivity:** Despite the phenomenal progress made in the recent years, the connectivity to rural areas still requires to be improved. Reliable connectivity is a prerequisite for a successful penetration of IT into rural areas. Many private ISPs are setting up large networks connecting many major towns and cities. Since some of these networks pass through rural areas, it is possible to provide connectivity to a large number of villages. Several technologies exist that can be utilised for connecting rural areas. Cable network is a possible medium for providing the last mile connectivity to villages.
- **Bandwidth:** Even in areas where telephone and other communication services exist, the available bandwidth is a major constraint. Since internet based rural services require substantial use of graphics, low bandwidth is one of the major limitations in providing effective e-services to farmers. As already stated, networks with high bandwidth are being set up by several companies passing through rural segments which can be utilised. Until this materialises, a two pronged strategy of storing static information at the kiosks and providing dynamic information from remote locations can be examined. The graphic oriented content which does not change frequently, such as, demonstration clips for farmers, can be stored on the local drives at the kiosks and arrange for periodic updation of this information over the network during non-peak hours. The dynamic information which changes more frequently can be accessed from remote locations to obtain the latest status.
- **Dissemination Points:** Mass deployment of information kiosks is critical for effective use of the Internet based content and services. In order to ensure that the information kiosks are economically feasible, it is necessary to make the proposition sustainable and viable. This requires a major focus on a viable revenue model for such kiosks. In the new information era, the kiosks should be designed to become electronic super markets that can, in addition to being information sources, handle other services of use to the people living in rural areas. The revenue available through such sources can make a kiosk attractive for prospective investors. The Government can provide finance facilities to unemployed rural agricultural graduates who can be expected to have greater commitment and at the same time act as an efficient interface for less educated rural visitors. The objective should be to transform rural information kiosks into 'clicks and mortar' gateway to rural India for 'Bricks and mortar' industry. Some of the sources that can generate revenue for rural kiosks are :
    - **Distance Education:** A large number of people travel substantial distances to attend educational courses. It is possible to set up virtual classrooms right in their villages.
    - **Training:** People living in rural areas require training and a means for upgrading their skills in their area of work. It is possible to provide quality education right at their door steps with facilities for online interaction with experts. For example, a village teacher or a paramedical staff can keep abreast latest developments without disturbing his/her routine. Similarly, training can be imparted on various aspects of agriculture such as correct practices, irrigation practices, efficient utilisation of tools used in farming such as tractors.
    - **Insurance:** The advent of private players into insurance has brought about advanced IT systems that can render services over networks. The kiosks can be insurance agents for insurance firms which, in turn, can compensate the kiosk operators for online transactions for new business as well as maintaining the old.
    - **Local Agent:** Many companies have difficulty in working out logistics for their supplies to rural outlets. A rural kiosk can act as conduit for such 'bricks and mortar' companies. This has the potential of transforming a rural kiosk into a profitable venture.
    - **Rural Post Office:** The kiosks can facilitate sending and receiving emails, facilitate 'chats' with experts. Several successful rural kiosks are already available in many states which run essentially on this model.

- **E-Governance:** Rural kiosks are the stepping stones for effective implementation of e-governance. Details related to central / state / local governments, formats and procedures, status verification such as case listings in courts, filing of applications in electronic format where admissible, etc. are some of the areas where kiosks can be of major use.
- **Online Examinations:** Online certification examinations are 'in things' with many organisations and certification agencies. Many people are forced to stay at metros to take the examinations. Eventually it should be possible to conduct these examinations through the rural kiosks.

- **Stake Holders:** At present, several initiatives have been taken in the form of websites / portals targeting rural India. These are at best sketchy information sources catering to pockets of rural India. It is to be noted that strong interlinkages exist within entire rural India and concerted and coordinated effort is required for carrying the benefits of IT to rural India. The magnitude of the task is such that no single institution or organisation can accomplish it. It is necessary for stake holders in rural India, such as fertiliser industry, to come together to provide adequate thrust to the effort initially. The fertiliser industry distributes more than 15 million tonnes of nutrients per annum in the country involving complex production, logistics and storage operations. A small savings made possible through better management of information up to the point of delivery to farmers can mean significant savings. The success of e-powering Indian agriculture is high if fertiliser industry makes a concerted and coordinated effort to set up Business to Business (B-B) market place with dealer / cooperative networks. The consumer industry also benefits from efficient operations in rural India. The corporate India may be willing to participate in a joint effort that proves beneficial to them as well as the rural India. The Government of India may, as outlined above, initiate a coordinating agency where various stake holders can join hands to spread e-culture to rural India and at the same time benefit from efficient operations.

Conclusion

The Indian farmer and those who are working for their welfare need to be e-powered to face the emerging scenario of complete or partial deregulation & reduction in government protection, opening up of agricultural markets, fluctuations in agricultural environment and to exploit possible opportunities for exports. The quality of rural life can also be improved by quality information inputs which provide better decision making abilities. IT can play a major role in facilitating the process of transformation of rural India to meet these challenges and to remove the fast growing digital devides.

The rapid changes in the field of information technology make it possible to develop and disseminate required electronic services to rural India. The existing bottlenecks in undertaking the tasks need to be addressed immediately. A national strategy needs to be drawn for spearheading IT penetration to rural India. A national coordinating agency with an advisory role can act as a catalyst in the process.

No single institution or organisation alone can succeed in the task of e-powering farmers and rural India. At the same time, scattered and half hearted attempts cannot be successful in meeting the objective. Industries with major stake in villages, such as fertiliser sector, should come together to provide the initial impetus. The success of any IT based service to rural India hinges on evolving a proper revenue model for the dissemination points. The information kiosks can draw revenue from the industry by providing and disseminating required services. Once these dissemination points prove to be economically viable, the IT revolution in rural India will require no crusaders.