Chapter VI

IT INFRASTRUCTURE AND AGRICULTURE MARKET

6.1 INTRODUCTION

According to Human Development Report 2001, “People, all over the world have high hopes that new technologies will lead to healthier lives, greater social freedom, increased knowledge and more productive livelihoods”. Information technology is affecting all spheres of life due to progress in the hardware and software technology. Now a days, it is possible to procure high-speed reliable computers with huge storage capacities at affordable cost. One can deliver and acquire the required information within no time using IT. A new development in IT also allows us to maintain information in different formats such as text, image, sound and video. The stored information can be extracted by millions of user simultaneously. Currently Internet speed is doubling every nine months\(^1\), as result within a decade, millions of Indian population will get enabled with mass customized and personalized services. Also, data mining and data warehousing technology can be used to extract and store large amount of useful data and knowledge to predict future. This IT based development will improve performance and utilization of all fields such as agriculture, education, health and medical services etc. The research challenge here is to identify the areas where progress in IT could be used to improve performance of these fields and build cost effective IT based systems that improve the living standard of rural population.
6.2 IMPORTANCE OF IT FOR AGRICULTURE

In recent years, agriculture is regaining attention not only in the minds of policy makers but also serious private sector players who see a huge opportunity of entering the rural markets. According to S.C. Mittal\(^2\), information of the required quality always has the potential of improving efficiency in all spheres of agriculture. Information Technology (IT) has a major role to play in all facets of Indian agriculture. In addition to facilitating farmers in improving the efficiency and productivity of agriculture and allied activities, the potential of IT lies in bringing about an overall qualitative improvement in life by providing timely and quality information inputs for decision making.

As per AAPAR\(^3\) report, Global organizations and several countries in Asia are witnessing very innovative use of ICT in agricultural and rural development. In national programs, India leads the pack with more than 40 percent of all ICT enabled rural initiatives in the region, followed by China, Malaysia, Thailand, Philippines, Pakistan, Bangladesh and others.

Realizing the extensive necessity of infrastructure to support agricultural development, Government of India initiated a large number of schemes over a period of time to support creation of agricultural marketing infrastructure both in the public and private sector. Such as Scheme for Technology Upgradation/ Establishment/ Modernization of Food Processing Industries\(^4\). Thus adequate infrastructure is a basic requirement for the development of IT.
6.3 IMPORTANCE OF INFRASTRUCTURE

Access to information, backed with relevant infrastructure and services not only allows rural population to improve its quality of life but also supports and supplements its existing income in a sustainable way. Access to information and services like e-Government, micro-credit, literacy, education, health, etc., can provide a solid foundation for the economic prosperity of rural India.\(^1\)

As stated in “Setu project memorandum of Maharashtra”, rural consumers are willing to pay for products and services that meet their needs and are offered at affordable prices. Therefore, what Rural India needs is a new social contract in which there will be common access infrastructure, provided at prices approved by the Government rather than given for free.

The aim of the Scheme is not merely to roll out IT infrastructure but to build a network of 100,000+ rural businesses across India. To that effect, the CSC (COMMON SERVICES CENTER) scheme has been designed to create a value proposition for all stakeholders and alignment of their economic interests.

Infrastructure development is the critical factor for determining the success of a market–oriented strategy and macroeconomic policies in developing countries. When market information technology is accessible to consumer, the producer can utilize the National Information Infrastructure (NII) and bypass all intermediaries. The marketing infrastructures and logistics must be adequate and ready to handle fast order and on-time delivery. Such facilities include: storage, transportation, communication, packaging; etc.
Communication infrastructure forms the backbone in any commercial/economic activity but more so in the case of food-grains since these have to be first transported from the Farms spread over in the rural areas and then to the market/storage points and ultimately to the distribution centers close to consumption areas.

6.4 IT INFRASTRUCTURE

K.C. Laudon and Jane P. Laudon\textsuperscript{5} define information technology (IT) as the shared technology resources that provide the platform for the firms’ specific information system applications. IT infrastructure includes investment in hardware, software and services such as consulting, education and training that are shared across the entire organization. Organizations IT infrastructure provides the foundation for servicing customers, working with vendors and managing internal firm business process. Better selection and management of its hardware and software technology results in enhanced efficiency and competitiveness of the organization.

According Weill, Perter, Mani Subramani and Marianne Broadbent\textsuperscript{6} IT infrastructure is a set of firm wide services budgeted by management and comprising both human and technical capabilities. These services includes following

- Computer platforms used to provide computing services that connect employees, customers, and suppliers into coherent digital environment, including large mainframe desktop and laptop computers and personal digital assistants(PDAs) and Internet appliances.
- Telecommunication services that provide data, voice and video connectivity to employees, customers and suppliers.
• Data Management services that store and manage corporate data and provide capabilities for analyzing data.

• Application software services that provide enterprise-wide capabilities such as enterprise resource planning customer relationship management, supply chain management and knowledge management systems that are shared by all business units.

• Physical facilities management services that develop and manage the physical installation required for computing, telecommunications and data management services.

• IT management services that plan and develop the infrastructure, coordinate with the business units for IT services, manage accounting for the IT expenditure, and provide project management services.

• IT standards services that provide the firm and its business units with policies that determine which information technology will be used, when and how.

• IT education services that provide training in system use to employees and offer managers training in how to plan for and manage IT investments.

• IT research and development services that provide the firm with research on potential future IT projects and investments that could help the firm differentiate itself in the marketplace.

6.4.1 Levels of IT Infrastructure

IT infrastructure is organized at three major levels⁵

• Public

• Enterprise

• Business Unit
All organizations are dependent of **public IT infrastructure**, which includes the Internet, the public switched telephone network, industry operated networks and other IT support facilities such as cable systems and cellular networks.

**Enterprise-wide** infrastructure includes services such as e-mail, a central corporate website, cooperate-wide intranets and an increasing array of enterprise-wide software applications.

**Business units** have their infrastructure that is uniquely suited to their line of business such as specialized production software and systems, customer and vendor system and local order entry and other transactions systems.

### 6.4.2 Evolution of IT infrastructure

The IT infrastructure in organizations today is an outgrowth of over 50 years of evolution in computing platforms. The five stages in the evolution, each representing a different configuration of computing power and infrastructure elements are shown in Table 6.1. The five eras are automated special purpose machines, general-purpose mainframe and minicomputer computing, personal computers, client/server networks and enterprise and internet computing.

### 6.4.3 Components of IT Infrastructure

IT infrastructure today is composed of seven major components:\(^5\)

1. Computer hardware platforms
2. Operating system platforms
3. Enterprise software applications
4. Data Management and Storage
5. Consultants and System integrators.
6. Networking and telecommunications hardware.
7. Internet platforms

These seven components must be co-ordinated to provide the firm with a coherent IT infrastructure. In the past technology vendors were often in competition with one another, offering purchasing firms a mixture of incompatible, proprietary, partial solutions. But increasingly vendors firms have been forced by large customers to cooperate in strategic partnerships with one another. For instance, a hardware and services provider such as IBM cooperates with all major enterprise software providers has strategic relationships with system integrators and promises to work with whichever database products its client firm wish to use. Let us see the details of these components

6.4.3.1 Computer Hardware Platforms:

The marketplace for computer hardware has increasingly become concentrated in top firms such as IBM, HP, Dell, and Sun Microsystems, which produce 90 percent of the machines, and three chip producers, Intel, AMD, and IBM, which account for over 90 percent of the processors sold in 2004. The industry has collectively settled on Intel as the standard processor, with major exceptions in the server market for UNIX and Linux machines, which might use SUN or IBM UNIX processors.

6.4.3.2 Operating System Platforms:

At the client level, 95 percent of PCs and 45 percent of handheld devices use some form of Microsoft Windows operating system (such as Windows
XP, Windows 2000, or Windows CE). In contrast, in the server marketplace, more than 85 percent of the corporate servers in the United States use some form of the Unix operating system or Linux, an inexpensive and robust open-source relative of Unix. Although Microsoft Windows Server 2003 is capable of providing enterprise-wide operating system and network services, it is generally not used when there are more than 3,000 client computers in a network. Unix and Linux constitute the backbone of corporate infrastructure throughout much of the world because they are scalable, reliable, and much less expensive than mainframe operating systems. They can also run on many different types of processors. The major providers of Unix operating systems are IBM, HP, and Sun, each with slightly different and partially incompatible versions. Although Windows continue to dominate the client marketplace, many corporations have begun to explore Linux as a low-cost desktop operating system provided by commercial vendors such as RedHat Linux and Linux-based desktop productivity suites such as Sun’s StarOffice.

6.4.3.3 Enterprise Software Applications:

The largest providers of enterprise applications software are SAP, followed by Oracle and PeopleSoft. In December 2004 Oracle purchased PeopleSoft. SAP and PeopleSoft promise to provide software that works with any hardware or operating system.

In general, most large firms already have implemented enterprise applications and have developed long-term relationships with their providers. Once a firm decides to work with an enterprise vendor, switching can be difficult and costly, though not impossible.
6.4.3.4 Data Management and Storage:

The leading IBM (DB2), O, Microsoft (SQL Server), and Sybase (Adaptive Server Enterprise), which supply more than 90 percent of the estimated $70 billion U.S. database software marketplace. A growing new entrant is MySQL, a Linux open-source relational database product available for free on the Internet and increasingly supported by HP and others in a move designed to prevent Microsoft from monopolizing the small and medium-sized firm database market with its SQL Server product.

6.4.3.5 Consulting and System Integration Services:

Software integration means ensuring the new infrastructure works with the firm’s older, so-called legacy systems and ensuring the new elements of the infrastructure work with one another. Legacy systems are generally older transaction processing systems created for mainframe computers that continue to be used to avoid the high cost of replacing or redesigning them. Replacing these systems is cost prohibitive and generally not necessary if these older systems can be integrated into a contemporary infrastructure. Consulting and system integration have become a lucrative market that can greatly expand the revenues of computer hardware and enterprise software vendors. IBM’s consulting services revenues now equal its hardware revenues, and for enterprise software firms such as Oracle and SAP, consulting, integration, and maintenance revenue exceed the revenues from software sales.
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<td>Signature Firm(s)</td>
<td>IBM Burroughs NCR</td>
<td>IBM</td>
<td>Microsoft/Intel Dell HP IBM</td>
<td>Novell, Microsoft</td>
<td>SAP, Oracle, PeopleSoft</td>
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<td>Hardware Platform</td>
<td>Programmable card sorters</td>
<td>Centralized mainframe</td>
<td>Wintel computers</td>
<td>Wintel computers</td>
<td>Multiple Mainframe, Server, Client</td>
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<td>Operating System</td>
<td>Human operators</td>
<td>IBM 360 IBM 370 Unix</td>
<td>DOS/Windows Linux IBM 390</td>
<td>Windows 3.1, Windows Server Linux</td>
<td>Multiple Unix/Linux, OS 390, Windows Server</td>
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<td>Application and Enterprise Software</td>
<td>None; application software created by technicians</td>
<td>Few enterprise-wide applications; departmental applications created by in-house programmers</td>
<td>No enterprise connectivity; boxed software</td>
<td>Few enterprise-wide applications; boxed software applications for workgroups and departments</td>
<td>Enterprise-wide applications linked to desktop and departments, including applications: mySAP, Oracle E-Business Suite, PeopleSoft, Enterprise O</td>
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<tr>
<td>Networking/Telecommunications</td>
<td>None</td>
<td>Vendor-provided: 1 Systems Network Architecture (IBM) 2 DECNET (Digital) 3 AT&amp;T voice</td>
<td>None or limited</td>
<td>Novell NetWare Windows 2003 Linux AT&amp;T voice</td>
<td>LAN, Enterprise-wide area network (WAN) TCP Internet standards-enabled</td>
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<tr>
<td>System Integration</td>
<td>Vendor-provided</td>
<td>Vendor-provided</td>
<td>None</td>
<td>Accounting and consulting firms Service firms</td>
<td>Software manufactured Accounting and consulting firms Service systems, System integration Service firms Service firm</td>
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<td>Data Storage and Database Management</td>
<td>Physical card management</td>
<td>Magnetic storage Flat files Relational databases</td>
<td>Dbase II and III Access</td>
<td>Multiple database servers with optical and magnetic storage</td>
<td>Enterprise database servers</td>
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<tr>
<td>Internet Platforms</td>
<td>None</td>
<td>Poor to none</td>
<td>None at first Later browser-enabled clients</td>
<td>None at first Later: Apache server Microsoft IIS</td>
<td>None in the early years, Later: Intranet-and Internet delivered enterprise services Large server farms</td>
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A. What Is Network?
A group of two or more computer systems linked together is known as computer network e.g. in the same room or scattered through a building or at distant places for exchange of data/ Information.

- It is more cost effective and productivity is also gained.
- It allows computers and their users to share information and resources.
- Its other uses are database server, computer server, email, chat, internet, etc.

Types of Network
Based on geographical dispersion of computers there are mainly three types of network.

- Local Area Network (LAN)
- Metropolitan Area Network (MAN)
- Wide Area Network (WAN)

a. Local Area Network
In this type of network computers and other communication devices are in a small area and are connected together (networked). The area can be single building, cluster of buildings in the same campus. Examples can be Local Area Network of Lab in which you may be working or a library which you may be using.
b. Metropolitan Area Network

A Metropolitan Area Network is basically a bigger version of LAN and normally uses similar technology. It might cover a group of nearby corporate offices or it can be in a city. It can be private or public.

c. Wide Area Network

Computers can be farther apart like covering cities, countries or even continents. The computers are connected by telephone lines or radio waves or optical fibers.

B. Network Topologies

Topology refers to the shape of a network or network’s layout. How different nodes in a network are connected to each other and how they communicate is determined by the network’s topology. There are four most common network topologies, namely(Fig 4.1)

i) Bus Topology,
ii) Star Topology,
iii) Ring Topology and
iv) Mesh Topology
Figure 6.1 : Network Topologies

Source : www.unesco.org/education/aladin/paldin/pdf/course02/unit_08.pdf

i) Bus Topology
All devices are connected to a central cable, called the bus or backbone.

ii) Star Topology
All devices are connected to a central hub. Nodes communicate across the network by passing data through the hub.

iii) Ring Topology
All devices are connected to one another in the shape of a closed loop, so that each device is connected directly to two other devices, one on either side of it.

iv) Mesh Topology or Point to Point
Network Devices are connected with many redundant interconnections between network nodes. In a true mesh topology every node has a connection to every other node in the network.
C. Network Components
The following are essential components for computer networking.
a) Network hardware
b) Transmission media
c) Network software

Let us discuss each component in some detail.

a) Network Hardware
The basic component of computer network hardware is a computer. Computers on a network can be divided into two categories,
i) server and
ii) clients or nodes.

Server is the computer of higher power, and speed. It costs more. To this computer resources are attached. And the clients, also known as nodes access, are the resources which are attached to server. In peer to peer computer networks there are no servers.

b) Transmission Media
Communication of data propagation and processing of signals is called transmission. Signals travel from transmitter to receiver via a path. This path is called medium. Medium can be guided or unguided.
i. Guided Media
In guided media, data is sent along a physical path i.e. cables. There are several types of cables used in network. The type of cable chosen for a
network is related to the network’s topology, protocol and size. Different types of cables are a) coaxial cables, b) Twisted pair copper wire, and c) Optical fibre cable.

a) Coaxial cable looks like cable that brings the cable TV signal to television.

b) Twisted pair copper wire cable looks like phone cable. Twisted pair cables come in two varieties,
   a. shielded and
   b. unshielded.

c) Optical fibre cable

ii. Unguided Media
Here no wire is installed. The data communication is predominantly sent by radio waves and microwaves.

c. Network Card
We will discuss about networking software. But hardware has also to be connected. Most important part of connection is the network card. This is the middle part of connection. These cards are 8 bit cards, 16 bit cards and 32 bit cards. Each card has its own method of sending information (network protocol) through the cable. The most commonly used is Ethernet Protocol. A network card is called Interface card, network adapter, a NIC etc. It is a circuit board or chip which allows the computer to communicate to other computers on a network.

d. Modem (MODulator / DEModulator)
A modem converts digital signals (computer signals) from the computer into analogue signals for transmission and vice versa for reception over a telephone line. There are four basic types of modems for a PC:
i) External,
ii) USB,
iii) Internal and
iv) Built-in.

External and USB are set on your desk outside the PC, while as Internal and Built-in are inside the PC. Present day modems have 56 kilobytes per second speed. ISDN (Integrated Services Digital Network) circuits are digital. In this conversion from digital to analogue is not required. Switches are basically bridges, but usually have multiple ports. Switches connect network segments, using a table of addresses to determine the segment on which a packet needs to be transmitted.

e. Hubs
A hub is used to connect multiple computers and devices via a dedicated cable. It is cheap and connections are easy. It generally has 4, 8, 12, 24 ports.

f. Router
These are used to connect networks and to determine the optimal path along which the network traffic should be forwarded. They are occasionally called gateways. There are other network devices like repeaters, bridges, ports, etc.

c) Network Operating Software
Network operating software (NOS) is a collection of software and associated protocols that allow a set of autonomous computers, which are interconnected by a computer network, to be used together in a convenient and cost effective manner. It is similar to any other operating system like windows, DOS, etc. except it operates over more than one computer. It controls operation of the network system, including who uses it, when they
can use it, what they have access to, and which network resources are available. At a basic level, the NOS allows network users to share files and peripherals such as disks and printers. They provide data integrity and security. The examples can be categories of NOS: The NetWare, LAN Manager, Solaris and Windows 2000 etc.

The main categories of network software are
i) Peer to peer software and
ii) Client / Server-based

i) Peer to Peer Software
In peer to peer networking operating software users can share resources and files located on their computers and can access shared resources on other computers. There is no central server. All computers in the network are equal. They have similar capabilities and resources. Examples of Peer to peer network software are Windows XP, Windows 98. When you are working in Microsoft Office Word under Windows environment, you can share the shared documents. It is possible because Windows XP is peer to peer networking software.

ii) Client Server Based (Two Tier)
This software is in two parts. One part which includes functions and services resides in one or more exclusive (dedicated) computers. This part is called server. It provides security and access to resources. Another part called ‘client’ resides on other computers (nodes / client). They access resources on the server. The network operating system allows multiple users to simultaneously share the same resources irrespective of physical location. Examples of Server based networking software are: Novel Netware, Windows NT, UNIX, Window 2000 etc.
iii) Client Server Based (Three Tier)
Here a client-software is split into two parts.
i) Browser (user-interface) (thin client)
ii) Logic.
Thus two tier client-server becomes three tier architecture. The logic which describes how to access and process data is moved to a new server. This new server is server for thin client. Nothing changes in the server side.

iv) LAN
Standards for LAN are Ethernet, LocalTalk (for Macs), Token Ring, the most popular in Ethernet Protocol. It allows for linear bus, star or tree topologies. Data can be transmitted over twisted pair, coaxial or fibre optic cable at a speed of 10mbps.

6.4.3.7 Internet
The Internet is a network of networks. It connects millions of computers and thousands of computer networks throughout the world. The Internet has revolutionised our society, our economy and our technological systems. The Internet represents one of the most successful examples of the benefits of sustained investment and commitment to research and development of the information infrastructure.

The Internet Society (ISOC) defines the Internet as a “global network of networks” which enables computers of all kinds to directly and transparently communicate and share services throughout the world. It provides for both communications capabilities and information services. It also constitutes a shared global resource of information, knowledge and means of collaboration and cooperation among countless diverse
communities. For communication on Internet it uses standard protocol which is called transmission control protocol, Internet Protocol or TCP/IP. Standardized communication protocols allow similar, dissimilar, near and distant computers to communicate with one another. The Internet protocols and standards are being defined from time to time by various international organization and committees after rigorous testing and reviewing.

a. Trends in Internet

Internet 2: It is a consortium being led by 200 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow’s Internet.

Internet 3: It includes the US Government’s initiative to provide high bandwidth network service.

b. Importance of Internet

The Internet is an “enabling technology”. When its introduction is sensitive to local values and committed to local capacity building, it offers important opportunities to

- Open dialogue: Low cost networking facilitates knowledge sharing, awareness of alternative perspectives, more open exchange.
- Improve governance: Raising efficiency, transparency, participatory system
- Improve social and human rights conditions: Expands access to better quality education, healthcare, disaster relief capacity and other services
- Reduce poverty: Opens new opportunities for bypassed groups (women, the poor, rural populations, children)
- Introduce economic opportunities: E-commerce, ICT-sector development etc.
• Improve environmental management, GIS: Food security early warning systems.
• Support indigenous knowledge: Communities document their knowledge.

c. Disadvantages of Internet
Advances in communication media (VoIP, Instant messaging, email), based on Internet technology have made computer mediated communication more rich and cheap. Yet, today, this potential for knowledge sharing is not fully realized. Indeed, the internet is by nature an anonymous medium in which people find it hard to place their trust. As a result, people who have had few or no face-to-face meetings are not likely to share knowledge.

d. Benefits of Internet
It supports and encourages the new learning environment, which is based on principles of active learning-reflecting the change in the culture of education from teacher-centred to learner centred. The Internet can be used for a variety of purposes from a library. Some of the purposes are
• to exchange e-mail instantly with institutions in India or abroad
• to participate in teleconferences with people on topics of internet or research problems like adult education
• to find out educational information from universities libraries and book stores all over the world
• to search on-line library catalogues for bibliographic data and other databases for textual data
• to have access to electronic journals, newsletters and in-house information of many organizations and institutions.
6.4.3.8 BROADBAND

Existing and emerging generations of digital information and communication technology (ICT) are vastly expanding our capacities to access social and environmental opportunity, especially those technologies that support broadband telecommunication (‘broadband’)

Broadband technologies comprise:

- Broadband telecommunication networks
- Digital telecommunication protocols (the Internet Protocol)
- Digital telecommunication appliances (computers, smartphones, cameras, software, etc.)
- Digital telecommunication applications (email, VoIP, peer-to-peer file sharing and videoconferencing, video and audio on demand, data archiving, etc.)

The essential value of broadband telecommunication is that it greatly expands access to social and economic opportunity, to the great benefit of communities both rural and urban in societies around the globe, at marginal cost to society and environment compared to, e.g., accessing opportunity with a car.

For rural and remote communities, broadband creates opportunities to:

- Reduce or eliminate social and economic limitations of isolation
- Access broad new frontiers of social and economic development
- Greatly improve the development, retention and attraction of youth, workers and enterprises
- Bring balance and vibrancy to urban-rural dialog
- Improve access to government services, reduce cost of services.
• Improve access to ratepayers, and responsiveness to local needs and opportunities.
• Reduce municipal operating costs (travel to meetings, etc.)
• Enable fuller participation in economies, societies and politics of the 21st century and beyond.
• Reduce financial, social and environmental costs of participation.
• Rural and remote communities presently have the greatest need for broadband telecommunication, and the most to gain from it.
• By revolutionizing social and economic communication within and between urban and rural populations, broadband offers a means of permanently reversing social and economic trends that have been hollowing out ecosystems and rural communities for over a century (urbanization)
• Broadband is essential to healthy rural development
• Broadband networks are essential infrastructure.
• Community leadership is the most effective catalyst for broadband development. Communities are where all the people are.

Rural communities require the best-conceived strategies for broadband development, especially network development Comprising the following elements:
• Building Networks
• Building Policies
• Building Traffic
• Building Knowledge
• Building Partnerships
6.5 INTERNATIONAL INITIATIVES OF IT INFRASTRUCTURE
Various International Initiatives of IT Infrastructure in Agriculture and Agriculture Marketing are listed below. It shows that how IT infrastructure is benefiting the rural as well as government for Agriculture Information.

6.5.1 AgriInfo: an agricultural information system based on a call centre in China

Agriinfo was piloted in the north of China. It shows that Agriinfo can remove barriers by transmitting agricultural information to rural areas and provide a multilayer information service to match different farmer demands. The rapid development of CTI technology has changed the way that an agricultural information system can be developed and information distributed. The essence of an integrated system is to distribute professional knowledge to farmers. These benefits have been greatly enhanced with the emergence of computer technology, especially the internet and voice telecommunications.

This is the attempt to develop and test an agriculture information system based on a call centre. The research demonstrates the possibility and potential benefits of using a call centre to strengthen agricultural information management and service. To test its usefulness, the system had been piloted in the north of China after the prototype was completed. After operating for a period of time, many useful suggestions have been received from various avenues. Valuable comments and feedback collected during the test and evaluation period include:
• The call centre acts as a useful tool to help integrate agricultural information systems with communication tools, such as telephone and mobile phone.
• It can provide a series of advantages such as efficiency, a high degree of flexibility and responsiveness, cost saving to meet user needs in different situations, and to save user time.

• It is a cost-effective way to develop the agricultural information system based on the call centre in China.

Compared with the simplex internet technique, the call centre has characteristics as follows:

• it has more potential customers because the telephone network is more available than the internet, especially in the more remote rural areas giving it huge market potential.

• It is less demanding on the user. To access the internet-enabled information system requires that the user be familiar with computers and have professional operation ability.

• The call centre enabled information system requires only that the user is able to hear and speak regardless of age to get useful information from either the agent or by voice navigation.

Agriinfo can provide both on-line communications (synchronous) and an off-line (asynchronous) service. It is a good complementary system to overcome the limitations of the traditional information system in also being able to deal with exceptional and difficult situations. End users welcome the system’s synchronous and asynchronous functions. The integration of basic and expert-level knowledge based with Agriinfo proves to be effective and useful. It enables Agriinfo to meet different user requirements in different situations. The tele-consultation system acts a good tool to collect agricultural expertise, agricultural cases, and user feedback, extend agricultural knowledge and techniques, and it can solve the problem of shortage of expertise in some regions. Agriinfo offers different paths for
delivering agricultural information and knowledge to the user.

Different types of emerging CTIs can complement one another to overcome the shortcomings of each system. ACRM module is useful to provide additional information on user requirements and profile by employing data mining and OLAP. In summary, the rapid development of CTI technology has changed the way that an agricultural information system can be developed and information distributed. The essence of an integrated system is to distribute professional knowledge to farmers.

6.5.2 South Korea’s Agricultural Information Service – A NARS (National Agricultural Research Systems) Initiative

Dr. Sahdev Singh in his report “Selected Success Stories on Agricultural Information System” reviews diverse applications of new ICT in rural farming areas of selected Asia-Pacific countries and identifies different models of such applications by analyzing the context of local situations. One of the success story is of “South Korea’s Agricultural Information Service”

RDA’s Agricultural Information Service

The Director of Technology Information, who reports to the Director General of Farm Management and Information Bureau of RDA, administers the Agricultural Information Service (AIS). The AIS has a staff strength of 45, including 31 researchers, 1 administrator, 7 computer specialists, 3 librarians and 3 technical support staff. The AIS is responsible for providing following support activities:

- Statistical Analysis Support
- Computer Support
- Information Development
- Information Management
- Cyber systems
- Agricultural Library

AIS disseminates information on newly developed technologies and efficient farm management practices through mass media such as internet (RDA web site), radio, television, newspapers, and magazines. RDA publishes a number of technical books, periodicals, pamphlets, leaflets, and posters for effective technology transfer. CD, DVD, VCR tapes, and other audio-visual aids are also made available to the extension offices. The areas of emphasis also include:
- Analysis of domestic and international agricultural trends
- Development of management technology for farmers
- Profitability analysis of agricultural and livestock production and economic analysis of agricultural technologies
- Information support for agricultural research and extension
- Enhancement of agricultural library service

AIS has integrated all national institutes into a high-speed network. Under the e-Government initiative of South Korean Government, AIS utilizes the principle of Core Customer Relations Management System (CCRMS), which is widely used in the service industry sector. The main functions of this system are e-mail consultation, Short Message Service (SMS), and crop-wise virtual meeting rooms as shown in Figure 6.2. The system has registered 35,000 farmers and 8,000 researchers or extension workers.
Figure 6.2: Customer Relationship Management Infrastructure of AIS
Source: AIS South Korea’s Agricultural Information Service

AIS produces databases of agricultural technology information and provide them through a special homepage, http://ccss.rda.go.kr, (Figure 6.2). Owing to the customized service, monthly visitors count more than 100,000. Technical problems raised by farmers are rapidly resolved by voluntary participation of researchers in answering the questions delivered through the internet. Internet-based training courses for farm managers are offered to help farmers as well as extension workers. These courses are rich in content and use up-to-date animation, flash and moving screen technologies for added attractiveness. Subject matter specialists within RDA serve as lecturers in these video courses delivered through the internet and on CD-ROMs. About 1,000 farmers or extension workers take the course annually.
AIS also maintains a knowledge portal for agricultural sciences and technology where individual researchers and experts interact with each other and are also able to share implicit knowledge, know-how, experience, case study and research output. Such informal interactions result in free flow of creative ideas, improved quality of research and collaborative projects, which benefits all, including the farmers. AIS also assists the farmers in developing their homepages for e-shopping malls.

6.5.3 Other regional and global ICT enabled initiatives:

Some examples of ICT enabled initiatives tested for agricultural development in the region as well as globally are as follows:

1. Farm Forums

Farm forums began in Canada in the 1940s and have been used to reach large audiences in India, Ghana, Tanzania, Botswana, Zambia, Benin, Niger and Senegal. Radio programs on farming issues are produced in
collaboration with agricultural extension services and broadcast using a ‘listen-discuss-act’ pattern of audience participation.

2. Radio Club

Radio Club is the francophone version of the farm forums. Radio Club was an early example of the empowerment approach. It involved listeners in selecting the topics for investigation, collecting the information, producing the programs, and finding solutions to location specific problems.

3. Radio Campaigns

Like farm forums and radio clubs, radio campaigns can involve study groups and print materials for follow up clarification, contextualization, decision-making, and action. However, they run for shorter periods and are often more intensively-focused, sometimes only focusing on single issues. They often involve collaboration between several agencies and because of their large audiences, use study group leaders for discussions on the issues covered in the broadcasts. Radio campaigns have been successfully employed in India, Tanzania, Botswana, and Zambia.

4. CGIAR Learning Resource Centre (CGLRC): (www.knowledgebank.irri.org/cglrc)

The CGLRC provides CGIAR learning resources in standardized electronic format to the agricultural and natural resources management community. This pilot repository of learning objects is hosted by IRRI in the Philippines. National institutions can use these learning resources and adapt them to the language, contexts, and specific learning needs of their users.
Some of the materials can be used by extension workers and farmers literate in English. The learning resources currently available include decision support tools, techniques in dry land agriculture, fishing and aquaculture, forestry, law and policy on the management of plant genetic resources, livestock breeding and diseases, plant breeding and genetics, rice production, soils, water and irrigation, and training materials for trainers.

5. ISNAR Learning for Institutional Innovation:

ISNAR (www.isnar.cgiar.org) (archived site) was one of the 16 Future Harvest Centers supported by the Consultative Group on International Agricultural Research (CGIAR). ISNAR, now an IFRPRI program, aims to contribute to the generation and use of knowledge to foster sustainable and equitable agricultural development and help bring about innovation in agricultural research institutions in developing countries. Its main areas of work is strengthening human capacity in institutional innovation in agricultural research. The outputs include training modules and materials, distance learning programs, publications, and radio and TV programs.

6. IRRI Rice Web:

IRRI Rice Web (www.riceweb.org) is a compendium of the history of rice, where and how it is grown, its processing and trade, recipes, research issues, terminology and literature. It has been developed by the International Rice Research Institute (IRRI) in the Philippines, in collaboration with the West Africa Rice Development Association (WARDA), Cote d’Ivoire and Centro International Agricultura Tropical (CIAT, Colombia. It has received international recognition as an
outstanding educational website for students, researchers and the community at large. The site is user-friendly and the information is multi-layered. For example, a click on ‘Research’ opens up a page providing access to critical research issues, international research centers, international rice research collaborative mechanisms, new research tools, research databases and conversion factors.

7. World Agro-Forestry Center (ICRAF):

ICRAF (www.worldagroforestrycentre.org) is concerned with raising awareness and providing training in agro-forestry and integrated natural resource management. It works in collaboration with a consortium of educational and training institutions, and its target groups are the rural poor in the developing countries of the tropics. It is beginning to use ODL and ICT to deliver its programs and form links with other global providers and learning systems.

8. Virtual Academy of the Semi-Arid Tropics (VASAT):

VASAT (www.vusat.org) is an information, communication and non-formal distance education coalition for rural communities and intermediaries led by the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) (www.icrisat.org). It comprises an e-library, working documents, a research projects database, an image library, meteorological data, IARC training material and other resources. VASAT’s partners are research institutions and councils, higher education institutions, corporate bodies, state government bodies and project groups, the Commonwealth of Learning, the International Water Management Institute, South Asia Regional Office, International Service for National
Agricultural Research (ISNAR) and the International Livestock Research Institute (ILRI) in South Asia.

9. Agricultural Knowledge and Information Systems (AKIS):

AKIS has been developed by the World Bank and FAO to link farmers, agricultural educators, researchers and extension workers and generate, share and utilize agriculture-related technology, knowledge and information. This webpage on the World Bank website covers topics.

10. Asia-Pacific Agricultural Research Information System (APARIS):

APAARI with the support from ACIAR and GFAR has been developing APARIS (www.apaari.org) since 1999 with an aim to promote the use of new ICT for better information and communication management (ICM) in agricultural research for development (ARD) of the Asia-Pacific region. APARIS has primarily been designed to serve as a regional de-centralized platform for efficient information and knowledge sharing among the region’s NARS, advocacy and capacity building tool for promotion of ICT in ARD. In this regional knowledge network, NARS are represented by their respective national agricultural information systems (NAIS or national nodes) through national information nodal points (NINP). APARIS also acts as a regional node linking NAIS to global (such as WAICENT, AGRIS, CARIS, WISARD, ASTI, AROW, CABI, etc.) and other regional agricultural information systems (RAIS) such as InfoSys+, AARINENA-RAIS, Agroweb-CAC, FORAGRO-RAIS, FARA-RAIS, e-NACA, AFITA, etc.
11. ENRAP

*Knowledge Networking for Rural Development in Asia/Pacific Region:* ENRAP, available through www.enrap.org, is an IFAD and IDRC funded initiative to support knowledge networking amongst rural development projects in Asia/Pacific region through strategic use of ICT by project staff and, ultimately, the agricultural communities.

12. Pan Asia Networking:

Pan Asia is an IDRC initiative designed to help researchers and communities in Asian countries find solutions to their social, economic, and environmental problems, understand the positive and negative impacts that ICT can have on people, cultures, the economies and societies, and develop ICT applications that can promote sustainable development.

13. Sustainable Development Learning Network (SDLearn):

SDLearn, formerly APRTC, is a continuing education e-learning program for agricultural educators and other professionals in the public, private, educational and NGO sectors involved in developing farming communities and promoting sustainable agriculture. The program offers courses, which contain interactive components, and cover topics such as ICT for agricultural professionals, integrated pest management in rice, cotton and vegetable cultivation, responsible pesticide use and integrated soil fertility management.
6.6 SUCCESSFUL PRIVATE IT INFRASTRUCTURE AT NATIONAL LEVEL- E-CHOUPAL

Innovative ICT application platforms are being created by private sector players in conjunction with local farmers. One such private initiative has been by ITC Ltd in the state of Madhya Pradesh. This initiative from ITC has become a benchmark today in the ICT initiatives in agro-sector. Several best practices can be learned from this initiative, namely:

- ease of replicability and scalability
- customization to meet the specific local needs and
- organizational commitment.

6.6.1 ITC- Profile

ITC Limited with an annual sale of US$ 2 billion from its diversified businesses is one of India’s largest corporations with its presence in tobacco, hotels, paper boards, foods fashion retailing and commodity export. International Business Division (IBD) started in 1990, a division of ITC is engaged in exports of a range of agricultural commodities. It contributes over 60% of ITC Group's total foreign exchange earnings. ITC-IBD has a focused approach on strengthening its core competencies in select commodities. Today, IBD continues to deliver agri-commodities like Feed Ingredients - Soyameal, Rapeseed Meal; Foodgrains - Rice (Basmati & Non Basmati), Wheat & Wheat Products, Pulses; Coffee, Black Pepper; Edible Nuts - Sesame Seeds, HPS Groundnuts, & Marine products like Shrimps and Prawns. ITC IBD’s largest item for exports is soybean meal (a rich source of protein) which are exported to the animal feed mills around the world, competing with several transnational trading companies, mainly from the USA, Brazil, and Argentina.
6.6.2 e-choupal Concept

e-choupal is a Hindi word which means “village meeting place”. Market is a meeting place where vendors and customers come together to do transactions. e-choupal is a virtual market place where farmers can transact directly with a processor and can realize better price for their produce. e-choupal has the advantages of the market but spans very large varieties of vendors and customers. Geographical distances do not restrict participation in the e-choupal. The main disadvantage of conventional market is that information asymmetry is inherent in the market where as e-choupal provides for transparent transactions. This enables the participation of smaller as well as larger players. Elimination of some layers of intermediaries allows for larger share of profits to reach the lower end of value chain. The main attractiveness of e-choupal is that it can be used for connecting large producers/small producers and small users/large users, thereby eliminating the need for hierarchy of brokers. Internet is used as a low transaction cost backbone for communication. Physical delivery of produce to the processor is still done through the existing intermediaries. e-choupal does not attempt total elimination of intermediaries, as intermediaries are indispensable in economy like India where intermediaries are adding value to the every step of value chain at a low cost. Intermediaries have the expertise in storage, transportation, quality assessment and counter party risk reduction, which are difficult to replicate. e-Choupal provides farmers with all the market information and this helps them to become market oriented. In e-choupal intermediaries are leveraged but they are dis-intermediated from the market information flowing to the farmers.
6.6.3 Business Model: e-Choupal

The e-Choupal model has been specifically designed to tackle the challenges posed by the unique features of Indian agriculture, characterized by fragmented farms, weak infrastructure and the involvement of numerous intermediaries, who block critical market information from passing to the farmers and use that information for getting a big margin for themselves. The intermediaries capitalized on the economies of information and economies of physical things, which are tied together in a bundle. Due to this, the farmers does not get the proper price of its product & they continue to live below the poverty line. But e-Choupal sets things in order as it smoothenes the flow of information to the farmers by dis-intermediating intermediaries from the chain of information flow and at the same time leverages the physical transmission capabilities of the them as they deliver critical value at every link for a very low cost in a weak infrastructure environment. Business model of e-choupal Figure 6.4.

Figure 6.4: Business Model: e-Choupal
Source: 'The case study of e-Choupal experience of ITC'
The project e-Choupal is ITC’s unique click & mortar initiative e-Choupal is an ICT platform for carrying out trade at a number of locations. In this, ITC sets up a back-up physical service support at the village level, called Choupal, through **Sanchalak**: a lead farmer, who acts as the interface between computer and the farmer. ITC accumulates information regarding weather, modern farming practices, and market prices from sources like Meteorological Department, Agri-universities, mandis (regional market) etc., and uploads all information on to e-Choupal web site. All information is customized according to local farmers requirements and provided into the local language through computer set up by ITC in Sanchalak’s house. Sanchalak access this information and facilitates its dissemination to farmers. Information regarding weather and scientific farming helps farmers to select the right crop and improve the productivity of their farms. Availability of market information helps farmers to become market oriented. They know what price ITC is quoting and the price prevalent in the local market, thereby helping better price realization for farmers. If farmer decides to sell to ITC, Sanchalak works as the aggregator of small farmers produce to sell them to ITC. Sanchalak also aggregates farmers input purchase orders for various items like seeds, pesticides and places them directly with the suppliers through internet and facilitate supply of high quality farm inputs as well as purchase of farm produce at farmers doorstep with the help of intermediaries as shown in Figure 6.4.

### 6.6.4 Information and Knowledge for farmers

e-Choupal is an ICT platform that facilitates flow of information and knowledge, and supports market transactions on line.

- It transmits **Information** (weather, prices, news),
- It transfers **Knowledge** (farm management, risk management)
• It facilitates sales of **Farm Inputs** (screened for quality) and
• It offers the choice of an alternative **Output**-marketing channel (convenience,
• lower transaction costs) to the farmer right at his doorstep

e-choupal is, thus, distributed transaction platform that brings together sellers, buyers along with information and service providers. e-choupal is a model with a number of non-conventional characteristics namely:
• customer centric
• capable of being used for many commodities and multiple transactions
• easily scalable once it is verified
• uses local talent and local people and develops local leaders
• can be extended to local as well as global procurers
• stimulates local entrepreneurs to extend their innovativeness
• uses all the existing institutions and legal frameworks and
• many others can join the market as transaction time is low.

**6.6.5 Infrastructure components of e-choupal**

**a. Sanchalak :**

*Sanchalak* is identified from within the village. Sanchalak was selected on the basis of their education, age, family size, caste, political lineage and other affiliation. Sanchalak is made to take a public oath in which he swears to perform his job without any bias with full honesty and commitment. It makes him feel responsible towards his personal deeds and village community. Sanchalak encourages farmers to become the member of e-choupal by explaining to the farmers various benefits, e-choupal can
provide. ITC employees are constantly available to his assistance during this time.

b. Installation and Training
ITC pays start-up costs, Computer & printer / solar panels / UPS with battery / optional VSAT (internet), entrepreneur pays electricity/ telephone / travel to office. An Internet kiosk is established in the house of Sanchalak. ITC employees impart operational knowledge of computer and Internet to him so that he can perform his task efficiently and effectively. Sanchalak surfs the website of e-choupal and provides the farmers with latest weather forecast, market prices and productivity enhancing advice. Sanchalak works as the aggregator for the produce of small farmers which is to be sold to ITC and also aggregates the input orders of farmers to be directly placed with the manufacturers. In return, Sanchalak has a transaction-based income stream (inputs & output). Some of the Sanchalaks are making close to Rs. 100,000 as income from solely their e-choupal operations. The best Sanchalaks are also awards given in the meeting of Sachalaks. This encourages other Sanchalaks to work efficiently and committed. The delivery mechanism of e-Choupal, in addition to being a low cost option, is also effective because the sanchalak is from within the community, and motivation becomes intrinsic because of this internalization. The most critical aspect here is the selection and acceptance of Sanchalak. ITC used a transparent mechanism and it is driven on performance criteria and public testimony.

c. Website content
ITC uses inputs from farmers to create the content for website. Involvement of farmers in content creation helps to easily customize the information as per the local requirements. Farmers at ITC do the focus
group discussion to identify the information required by the farmers in village. Layout of website, language of information, contents all are decided on the advise of the farmers. Participation of local farmers ensures provision of adequate and decipherable information to e-choupal, which can be employed into the farming, or pricing of the produce. The increased participation in e-choupal has been due to the creation of win-win situation in which both the firm and the farmer benefits equally. The farmer gets attracted towards e-choupal due to increased profits, added services that he could get, saving in time, and the ability to use the e-choupal for many transactions.

d. Transaction Cost reduction through e-Choupal:

e-choupal operation has been successful. It has reduced the cost of procurement and the cost of transit and the material handling cost. Procurement transaction costs are reduced from the industry standard of 8% (farmer incurs 3% and the processor incurs 5%) to 2% (with farmer saving all his 3%, and the processor – ITC – saving 3%). The total cost incurred on the initiative so far has been Rs 50 Mn (Rs 35 Mn capital cost towards computers and other hardware at the kiosks as well as central servers + Rs 15 Mn revenue expenditure incurred towards portal development, people overhead etc). But ITC has accrued a benefit Rs. 20 Mn, which is the equivalent of full investment on 40% of the choupals (kiosks). This came from the procurement of 60,000 tonnes of soyabean.
6.7 OTHER IT INFRASTRUCTURE INITIATIVES AT NATIONAL LEVEL

6.7.1 aAQUA⁹:

aAQUA is an online multilingual, multimedia Agricultural portal for disseminating information from and to the grassroots of the Indian agricultural community. aAQUA simultaneously addresses two major challenges in farmer outreach programs - geographic reach and customized delivery. It answers farmers queries based on the location, season, crop and other information provided by farmers.

6.7.1.1 Agri-price information (Bhav Puchiye)

Farmer schemes and various operations support databases (aAQUA-QoS) have also emerged from the experience of aAQUA deployments. According to researchers¹ agriculture extensions and farmers outreach programme face three main challenges cost-effective outreach, solutions tailored to individual farmers and an image that is farmer-friendly. The internet and mobile networks have the potential to provide agro-information services that are (i) affordable, (ii) relevant (timely and customized) (iii) searchable and (iv) up to date. But one of the big barriers are the lack of agro-content that (i) is in the language of the farmers (ii) is relevant to their needs and (iii) is delivered in a form that is of immediate use to them.

aAQUA, Bhav Puchiye and a digital library of Agricultural Bhav Puchiye (meaning, "ask for the price", in Hindi) is a web-based application for viewing the price and price history information of agrarian products at the nearby wholesale markets (called mandis).
6.7.1.2 Bhav Puchiye User Interface:

incorporates innovations from the perspective of interface design and data provisioning. An iconic interface is presented to the user with a choice of commodities, the available varieties (from which the user chooses the commodity and variety of interest) and a calendar (from which the user selects the date of interest). The prices are displayed spatially over a map. The user can decide where to sell his produce to get the maximum profit, depending on the prices and the distance of the markets. The user can create a login, store profiles of commodities and locations and create and receive e-mail alerts when prices of certain commodities of interest change in the markets of interest.

6.7.1.3 Crops Library

Crops Library consists of collections of crop diseases (Cropp Doctor), crop recommendations and translated aAQUA threads. A user of Crop Doctor browses through a gallery of images classified by Crop and Disease names. He/she can choose a matching image and read the symptoms, causes, prevention and control of the disease. A user of Crop recommendations chooses a crop of interest classified as vegetables, fruits, cereals and pulses, flowers. A user of aAQUA Translations collection can choose to view the questions and answers in English, Hindi or Marathi.

6.7.1.4 Technology

Employ the three tier web architecture using Java technology (Java Server Pages/Servlets) and Oracle (aAQUA) or MySQL (Bhav Puchiye) databases based on the standard MVC (Model View Controller) architecture, they are
compatible with any Servlet container which supports JSP 1.2 and Servlet 2.3. Documents are uploaded to the server and indexed by meta-data provided by a librarian.

6.7.1.5 User friendliness

A tool provides a simple, yet rich interface suitable for new internet users. A web-based keyboard is also available to assist users. Some agricultural and veterinary problems are better addressed by photographs or audio and video files which provide details to the expert. It remains an open research issue especially when catering to different sets of users- farmers, experts, agri-businesses – both from literacy as well as expertise point of view. The interface design of Bhav, which aims at maximizing the relevant results with minimal inputs from the users. Every mouse click in Bhav Puchiye refines the results.

6.7.1.6 Offline Access

aAQUA pages are designed to have a lower payload and can also be installed as a standalone application which connects to the internet whenever available. The offline version of aAQUA is created for such users and can be personalized based on individual or group profiles and access patterns. It incorporates a store-and-forward mode, delaying authentication and allowing users to login and ask questions. In order to improve the response time and robustness in delivery of content, aAQUA mirrors are deployed closer to the users. These mirror sites periodically synchronize with the main aAQUA server with the help of our synchronization tools for databases of different vendors (Oracle and MySQL).
6.7.1.7 Language Independence

When a user types a query, the system converts it to a UNL query graph and looks up the UNL document base to find matches. (Also called Virtual fora) (E.g. Onion invokes all Onion related threads – independent of language). Crop Library and Bhav Puchiye have also been localized in Hindi and Marathi.

6.7.2 NICNET Based Agricultural Marketing Information System (AGMARKNET)

6.7.2.1 Introduction

Almost all the States and Union Territories are providing market information in one form or the other for the benefits of market users like producers, traders and consumers. However, the information is collected and disseminated by use of conventional methods which cause inordinate delay in communicating the information to different target groups, and thus adversely affecting their economic interest. Therefore, there is an urgent need to bring improvement in the present market information system by linking (i) all Agricultural Produce Wholesale markets in the States and Union Territories, and (ii) the State Agricultural Marketing Boards and State Directorates of Agricultural Marketing, with the Directorate of Marketing & Inspection of the Ministry of Agriculture, for effective and efficient information exchange. Investment in networking of about 7000 Wholesale Agricultural Produce Markets in the Country will facilitate globalisation of Indian Agriculture (and also globalisation of Indian Markets) in addition to strategically establish Supply-Chain Model (SCM). In view of this importance, the Department of Agriculture & Cooperation, in the Union Ministry of Agriculture has sanctioned a Central Sector
Scheme "NICNET Based Agricultural Marketing Information Network (AGMARK-NET)", Project Cost estimate of about Rs.10.00 Crores, to link 810 nodes (735 agricultural markets and 75 State Marketing Boards/DMI offices) to begin with, through its attached office, Directorate of Marketing and Inspection (DMI), during the year 2000-02. During the X five year plan, further expansion to 2000 additional markets, Regional Portals and GIS based National atlas of Markets has also been approved. As part of the expansion programme, 537 more markets are networked during 2004-05.

6.7.2.2 Objectives of AGMARKNET

The Objectives of the Central Sector Scheme “Agricultural Marketing Information System Network” are as follows:-

i) To establish a nation-wide information network for speedy collection and dissemination of market information and data for its efficient and timely utilization.

ii) To facilitate collection and dissemination of information related to better price realization by the farmers. This would cover:

(a) 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.

(b) Price-related information such as minimum, maximum and model prices of varieties and qualities transacted, total arrivals and dispatches with destination, marketing costs and margins,

(c) Infrastructure related information comprising facilities and services available to the farmers with regard to storage and warehousing, cold storage, direct markets, grading, rehandling and repacking etc.; and
(d) Promotion related information covering accepted standards and grades, labeling, sanitary and phyto-sanitary requirements, pledge finance, marketing credit and new opportunities available in respect of better marketing;

iii) To Sensitize and orient farmers to respond to new challenges in agricultural marketing by using ICT as a vehicle of extension.

iv) To Improve efficiency in agricultural marketing through regular training and extension for reaching region-specific farmers in their own language.

v) 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.

6.7.2.3 National Informatics Centre

National Informatics Centre (NIC) is the nodal S &T organization in the Ministry of Communications & Information Technology, for informatics development and networking in government, corporate and cooperative sectors for decision support. NIC offers state-of-the-art network services in the country, over C-band and Ku-band (TDMA, FTDMA & SCPC) VSATs, Wireless Metropolitan Area Networks (MANs) and Local Area Networks (LANs) with NICNET gateway for Internet resources, so as to facilitate economic, social, scientific and technological activities, and also for “macro-economic adjustment programme” of the Government. NIC implements IT projects, in collaboration with the Central/State Governments, in respect of

(i) Centrally Sponsored Schemes
(ii) Central Sector Schemes,
(iii) State Sector & State sponsored Programmes, and
NIC provides the state-of-the-art IT solutions to information management, information dissemination, and decision support requirements of the Central as well as state Governments, the Corporate Sector and the Cooperative Sector. NIC plays

- Data warehousing (Data Bases & Model Bases)
- Network services (Internet, Intranet, & Extranet)
- Geographical Information System (GIS)
- Application of Remote Sensing Data
- Multi-media Information System,
- E-Governance & E-Commerce,
- Decision Technology
- Sectoral IT Plans
- IT Training for Government Employees – IT empowerment
- NICNET Video Conferencing

NIC Project Offices have been established in 1980s, with NICNET facilities for Internet & Intranet access, through an Memorandum of Understanding (MOU), in all the Central Government (Civilian) Departments/ Ministries, 28 State Government Secretariats, 6 Union Territories Administration Secretariats ) 1 National Capital Territory Government Secretariat, and 550+ District Collectorates.

6.7.2.4 Directorate of Marketing & Inspection (DMI):

The Directorate of Marketing and Inspection (DMI), headed by Agricultural Marketing Advisor to the Government of India (AMA), implements agricultural marketing programmes of the Central Government, under the supervision and control of the Central Ministry of Agriculture.
DMI aims at bringing integrated development of marketing of agricultural and allied produce in the country, and maintains a close liaison between the Central and State Governments through its regional offices (11) and sub-offices (37) spread all over the country. DMI has a network of 22 regional Agmark Laboratories with its Central Agmark Laboratory at Nagpur. Its functional responsibilities include

- promotion of standardization and grading of agricultural and allied produce;
- market research and surveys;
- manpower training in Agricultural Marketing;
- market development through Regulation, Planning and Designing of physical markets;
- marketing extension to educate consumers/producers;
- administration of Meat Food Products Order (1973);
- promotion of Cold Storage; and
- market information network

6.7.2.5 Agricultural Marketing Information System

Marketing of agricultural products comprises different business activities, different flows of products (called “marketing channel”) and different firms (called “middle man”) performing two main functions:

- Physical handling, storage, processing and transfer of goods as they move from producers to consumers – “operational efficiency”; and
- Exchange and price setting processes in the market system – “pricing efficiency”

As in all aspects of business, realising potential net gains of efficient marketing activities requires technically sound analysis. Increasing
competition and complexities in agricultural marketing will require more sophisticated analysis and understanding (Information Technology diffusion) in the future than what has been in the past. The availability of prompt and reliable market information about what is happening in the market, what quantities are arriving and what prices are quoted for different commodities considerably improves the decision making capability of the farmers and strengthens their bargaining power. At present, the information is disseminated through various media like radio, newspapers, blackboard display and public address system at Wholesale Market yards. The information provided by these methods has a limited use and does not help much to the farmers in taking decisions in marketing of their produce. The farmers are also not able to know about the prices prevailing in other markets, as the Market Committees are able to disseminate information mostly in respect of their own markets. The farmers are, therefore, left with no alternative but to dispose off their produce in the nearest market, even at uneconomic prices. Further, the market intelligence data are presently compiled in registers, which are difficult to maintain. It is also difficult to analyse the voluminous information thus collected for making decision. Therefore, a need has been felt to improve the existing market information system by linking all the important Wholesale Markets in the States and Union Territories, the State Agricultural Marketing Boards, and State Agricultural Marketing Directorates, under Agricultural Marketing Information Network, by installing computer facilities and connecting with NICNET for Internet and Intranet services.

A large amount of data with more accuracy, can be stored in computer, analysed and retrieved within shortest possible time. AGMARKNET will ensure dissemination of data through network to any distance with the help of communication devices for the benefit of citizens, farmers, traders,
consumers, etc. The improved communication system will enable the producers to know about probable markets where they can dispose of their produce more profitably. The traders and consumers can also derive maximum advantage out of their purchases at low communication cost. The modernisation of market information system, will lead to the efficiency in the markets and increased participation of the farmers. This efficiency of the markets and farmers participation in the markets will be increased. This will increase the income of the farmers which, in turn, will activate them to increase the agricultural production.

6.7.2.6 Project Implementation

The scheme is being implemented at Agricultural Produce Wholesale Markets, State Agricultural Marketing Departments/Boards (Annexure-II) by DMI through National Informatics Centre (NIC) on a turn-key basis. NIC will procure, install and maintain the hardware, software, connectivity, impart training to computer operators and implement a customised application software in the identified AGMARKNET Nodes (Wholesale Markets) under this scheme and State Agricultural Marketing Departments/Boards. The software will facilitate transmission of daily prices (Minimum, Maximum, Modal) [commodity-wise, varietywise, originwise, gradewise] and arrivals data [commodity-wise], to the respective State Marketing Boards/ Directorates and DMI Headquarters for updating in the AGMARKNET server for Internet/Intranet Access.
6.7.2.7 Networking

The Directorate of Marketing and Inspection (DMI), Faridabad has been equipped with (i) one State-Of-Art FTDMA KU Band VSAT, (ii) a powerful Computer Server, and (iii) Software tools, to facilitate the development of AGMARKNET as an INTRANET over NICNET. Each identified Wholesale Market will be linked to NICNET for up-linking data, via Dial-up connection, through email/ftp services, for which Rs.2750 per annum has been earmarked for Internet Access Charge. The comprehensive database on Prices and Arrivals and other related aspects is being maintained at AGMARKNET central database for generating various analytical reports. Necessary interface, using the local language support, for transmitting the daily data has been developed and customized at AGMARKNET Nodes, by NIC State Units.

6.7.2.8 Training

Necessary training programmes (in batches of about 25) are arranged with the support of the NIC State units and NITPUs, for which approved project funds are made available to them. During IX Plan, one official from each market was imparted training under the project. During X Plan, provision has been made to train two officials from each market. The respective State Marketing Boards/Directorates have to nominate these officials for undergoing at least 5 days training on computer handling & awareness and application software, for transmission of data. Further, provision has been made to conduct 3 types of training viz Basic Awareness programme, Research & Analysis and Refresher training. The nominations should be notified to NIC at least 3 weeks in advance.
6.7.2.9 Software Tools

At each AGMARKNET node, the following Software Tools are provided:-

- Operating System - Windows 98/XP preloaded along with the Recovery CD;
- Office Productivity Tool - Lotus Smart Suite Millennium; and
- Application Software – “AGMARK”, developed using Lotus Smart Suite, to facilitate the daily flow of Market Information on prices and arrivals.

The software tools earmarked for DMI Headquarters are:

- Operating System : Windows NT
- RDBMS : MS SQL Server 7.0
- Office Productivity Tool - Lotus Smart Suite Millennium and MS Office 2000
- Application Software – “AGMARK-National Level”, developed using Visual Basic & Seagate Crystal Reports, to facilitate the daily downloading of market information on prices and arrivals and for generating Analytical Reports.

6.7.2.10 Hardware Tools

At each AGMARKNET node and State Agricultural Marketing Directorates and Boards, the following Hardware will be provided

- Client System : One
- Power Supply (500 VA Line Interactive UPS) : One
- Communication Equipment (Modem) : One
- Printer ( 80 Column) : One (supporting Hindi, English and a local language by default)
At DMI Headquarters, the following Hardware will be provided:

- Server System (Wipro) : One (Server Pentium-III 450 MHz, 128 MB RAM, 18 GB HDD,
- 17” Digital Colour Monitor)
- Client systems (HCL Infiniti Model) : Two
- Power Supply (Tritronics) (2 KVA on-line UPS) : One
- LAN Switch (12-port) with accessories (Baystack 304) : One
- Communication equipment : One (M/s Gilat FTDMA KU Band VSAT with sky surfer Card)
- Printer, Laserjet Printer (Xerox Modicorp) : One
- Inkjet Printer (Xerox 9520+) : Two

6.7.2.11. Information Flow from Wholesale Markets

As the scheme envisages to establish a nationwide information network for speedy collection and dissemination of market information data for “pricing efficiency”, all AGMARKNET Nodes in wholesale markets will enter the data, in the prescribed format, using the customized application software “AGMARK”. This software will facilitate marketwise time series analysis of data, and also at state level and national level.
6.7.2.12 Agricultural Products (Commodities) Details

Marketing of agricultural-related products involve physical handling, storage, processing and transfer of raw and finished goods (commodities), as they move from producers to consumers. There are a number of commodities handled in different Wholesale Markets spread all over the country. However, DMI has identified the following major commodities (Group 1-7) of their interest as of now, for which daily monitoring with respect to prices and arrivals is desirable:

- **Cereals** (Wheat, Maize, Paddy, Rice, & Jowar) - **Group 1**
- **Pulses** (Bengal, Gram, Red, Gram, Green Gram, Black Gram) – **Group 2**
- **Spices** (Ginger, Garlic, Chilies (Red))- **Group 3**
- **Fruits** (Mango, Apple, Orange, Banana, Pineapple, Grapes) – **Group 4**
- **Vegetables** (Onion, Potato) – **Group 5**
- **Fibres** (Cotton, Jute) – **Group 6**
- **Oilseeds** (Groundnut, Mustard, Soyabean, Sunflower) – **Group 7**
6.7.3 All India Radio Farm School Program: This program began in the 1960s, had considerable success and reached many thousands of smallholders. The programs were broadcast in 144 districts and special farm units were established in 46 radio stations to provide a farm broadcasting service daily.

6.7.4 Kothmale Community Radio: The Kothmale Community Radio Internet project (www.kothmale.net) was designed to test an ICT access model for 200,000 people in marginalized communities in the central hill region of Sri Lanka. Supported by UNESCO, the project used community radio as an interface between the community and the Internet. The community radio station broadcast daily 'Radio Browsing the Internet' programs in which the presenters, supported by studio guests, browsed the Internet live with listeners who had requested them to surf the Web on their behalf. The information accessed was explained and contextualised with the help of the studio guests. The communities were also encouraged to develop their own Web sites and produce content that could then be hosted on the station's server. Users included local farmers and producers.

6.7.5 Tamil Nadu Agricultural University (TNAU): The TNAU Directorate of Extension Education was one of the pioneers in distance education to help farmers, farm women and rural youth in India learn new production technologies and adopt new technologies. The Directorate provides Farm Schools on All India Radio, which broadcast 13 lessons over 3 month periods at the rate of one lesson per week organize one-day contact programs for participants to discuss issues with the scientists and program presenters. It also offers correspondence courses, also conducted over 3 month periods by mailing out six audio cassette and print lessons per
fortnight and organizing three-day contact programs at the end of the courses. Video lessons in agriculture and allied fields are also broadcast or distributed on cassettes to farmers, extension workers, government and non-government organizations, etc. The Directorate plans to strengthen its ICT system.

6.7.6 Yashwantrao Chavan Maharashtra Open University (YCMOU): The YCMOU (www.ycmou.ac.in), established as a state open university in 1989, collaborates with local government agencies and NGOs to provide non-formal education on agriculture and crop production and other programs, using distance education and self-study print and audiovisual materials, study groups and practical demonstrations.

6.7.7 National Institute of Agricultural Extension Management (MANAGE): MANAGE (www.manage.gov.in) is responsible for the Innovations in Technology Dissemination (ITD) component of the National Agricultural Technology Project (NATP) being implemented with World Bank assistance by the India Ministry of Agriculture. ITD will provide computers and Internet connection for all participating agencies, researchers, extension managers and farmer clients in 28 districts in 7 States, videoconferencing between the participating organizations, training and information for farmers on, e.g., crop technology and market intelligence, and funding for the communication expenses. It has set up a network of information kiosks to provide training in and access to ICT for disadvantaged rural communities. These kiosks offer information on, e.g., farmers’ rights, loans and grants. The basic aim is to re-orientate extension to be more demand-driven, integrated with research and directed towards self-sustainability and farmer-centered decision-making.
6.7.8 NAARM Virtual Learning Centre (VLC): VLC is a pilot site of The National Academy of Agricultural Research Management in Hyderabad, Andhra Pradesh, designed to build the capacity of India’s NARS in Research Management by providing online, non-formal, free and interactive learning in agricultural research management, information management and human resources management that can be emulated by the various institutions of NARS. All courses are designed by the faculty of NAARM to facilitate easy learning and interaction.

6.7.9 M. S. Swaminathan Research Foundation (MSSRF): MSSRF (www.mssrf.org) seeks to impart a pro-nature, pro-poor and pro-women orientation to job-led economic growth in rural areas by harnessing science and technology for environmentally sustainable and socially equitable development. Its Honda Informatics Centre collects, collates and disseminates actionable information through various database services. The Farmers' Rights Information Service is a multimedia database on agrobiodiversity in India and tribal communities' contributions to conservation and biodiversity. The Every Child a Scientist Centre provides underprivileged children with opportunities to nurture their inherent talents through the use of ICT. The Information Village Research project, Pondicherry, uses ICT and local languages to provide market information, education, employment news, and information on health, crops, weather and fishing conditions to 12 underprivileged villages. The Hindu Media Resource Centre takes scientific issues to the wider community. The MSSRF-TATA Virtual Academy for Food Security and Rural Prosperity is also under development.

6.7.10 Gyandoot: Gyandoot (www.gyandoot.net) is an award-winning intranet in Dhar district in Madhya Pradesh that connects rural cybercafes
to the Internet and serves the everyday needs of the local people. The cybercafes are located on the roadsides of the central villages where people normally travel. Together, they serve over half a million rural people, who can access prices and volumes of local and national agricultural produce markets on a daily basis, print out land records for crop loans from banks, apply for caste, income and domicile certificates and other government services, gain public grievance redressal, and access rural Hindi e-mail, employment news, a rural newspaper, and various e-learning and e-advisory services.

6.7.11 Indian Society of Agribusiness Professionals (ISAP) e-group: ISAP (www.isapindia.org) is a network of professionals in India and the SAARC countries that serves farmers and small rural entrepreneurs and the many agricultural graduates who fail to find gainful employment or work in isolation. It uses a mix of face-to-face meetings, seminars and workshops, e-mail, discussion lists, SMS, telephony, a Website and Agri-clinics to share information nationwide. It is run by professionals in irrigation, food processing, international trade, research, and agricultural extension. It is probably the largest agriculture and rural development professional network in the world. It has registered over 9000 members, 75 chapters, 400 NGO partners, and 110,000 farmers and has answered well over 3000 queries/problems raised by the farming community. ISAP was selected by Digital Partners, USA, as one of the Most Promising Social Enterprises for their 2002 Award.

6.7.12 Indigriline by EID Parry: The AgriPortal of EID Parry (www.indigriline.com) is designed to address the specific needs of the rural farming community and catalyze e-commerce in agricultural and non-farm products by offering a network of partnerships. The content is
developed in Tamil by EID Parry in collaboration with the Tamilnadu Agriculture University and its Research Stations, Tamilnadu University for Veterinary and Animal Sciences, National Horticulture Board, AMM Foundation, Murugappa Chettiar Research Centre, and other players in agricultural media and publishing.

6.7.13 Multichannel Learning Centers: The Education Development Centre (EDC) in Papua New Guinea provides technical assistance in community-based learning for sustainable development. With funding from the Norwegian Rainforest Foundation, the EDC has teamed up with partners to organize the 10 tribal groups of the Managalas Plateau into a micro-enterprise to jointly harvest, market and export local crops. EDC provides Multichannel Learning Centers (MLCs), which use a variety of media to educate the people about the issues involved, and interactive radio instruction, which combines broadcasts, drama, audience participation and other learning methods. Local clans gather round the radio, listen to the programs in pidgin and then hold meetings on managing and conserving their part of the rainforest under threat from loggers and land developers. This approach is an improvement on earlier efforts that were over-reliant on extension workers with a limited understanding of the issues and print materials that the people found difficult to follow. The programs are also distributed to students in schools, women's groups, and literacy and reading clubs.

6.7.14 Pinoy Farmer Business Development: Pinoy Farmer Business Development was initiated by the Philippines Department of Agriculture in partnership with Winrock International to develop an ICT-supported extension service. The project aims to help local farming and fishing communities make sound business decisions, create new business
opportunities, and achieve profitable and sustainable farm innovations. The farmers access information on new technologies and markets through radio and TV programs, and receive support for improved crop production, quality control methods, processing, packaging and marketing.

6.8 MAHARASHTRA STATE AGRICULTURE PRODUCE MARKETING BOARD (MSAMB)

MSAMB, which is headquartered in Pune, was established on 23rd March 1984, under section 39A of Maharashtra Agriculture Produce Marketing (Development & Regulation) Act, 1963. Its mandate is to develop and coordinate the agricultural marketing system in the state of Maharashtra. Among other things, MSAMB coordinates the functioning of the Agriculture Produce Market Committees (APMCs), including programs undertaken by such Market Committees for the development of markets and market areas. The board also undertakes state level planning of the development of Agriculture Produce Markets.

6.8.1 Sharing market information

MSAMB's hallmark project is MARKNET, an agricultural market intelligence network in Maharashtra State. It is a network of computerized APMCs, established to provide comprehensive information system solution to APMCs in the State. The benefits to the farmer community are in terms of increased transparency of price information. Prices of agricultural produce available through APMCs are put up on a daily basis. With access to such information easily available, farmers can make a more informed choice and thus get a better price for their agricultural produce.
There are 295 regulated markets (APMCs) and 609 sub markets in the state; out of these 291 APMCs and 54 sub yards have been computerized and connected to MSAMB's Web site through Internet. At APMCs, daily arrival and price data is entered by a computer operator using customized data entry software provided by MSAMB. The software has an interface in Marathi, the regional language. Data entered into the application is being uploaded on MSAMB's Web site (www.msamb.com) by each APMC. All computers and peripherals have been provided free of cost to these markets under the AGMARKNET scheme of Director of Marketing & Inspection (DMI), Govt. of India.

MSAMB’s IT department comprises of an IT manager, two system analysts, four programmers and four data entry operators. At its head office in Pune, the LAN connects 6 servers and 95 clients. At the head office, broadband internet facility has been provided to all departments. Separate Web & mail servers with leased line facility have been set up. Similarly, computers and broadband facility have been provided to seven divisional offices of MSAMB.

MSAMB set up its own network in 1995. It's only now that the state-sponsored State Wide Area Network (SWAN) is being rolled out. In-house software development is done with .Net as front end and SQL as back end. Multi-user Tally software is being used for on-line accounting activities. MSAMB also provides consultancy about computerization to its associates such as Director of Marketing (M.S.), Horticulture Training Center, APMCs, etc.
6.8.2 Display systems in action

MSAMB has initiated a scheme of installation of Market Information Display (Projection TV System) for displaying market information at market yards. The idea is to display daily arrivals and prices of agricultural commodities at various markets for the use of farmers. Presently 69 APMCs have implemented this system. Market Information Displays (Projection TV Systems) are installed at Market Yards in such a way that viewers can easily see the information. This system consist of one computer, UPS, Internet, Projection TV of 44" or 54" size, device connecting TV and computer and software for displaying price information in Marathi language.

Customized software provides an option of displaying either APMC wise or commodity wise arrival and price information in Marathi language on the Projection TV. Based on the income of APMCs, MSAMB is provides subsidy of 33% or 50% to implementing APMCs. Besides price data, the system is used to display information related to agriculture, viz. pre & post harvest technology, good agricultural practices, grading, packing. It also displays information about new seeds, pesticides, fertilizers, various deceases & remedies as well as information about various schemes and projects of the state and central government. APMCs have been informed to display commercial advertisements while displaying price and agricultural information, to get the revenue to keep the system functional.

6.8.3 SMS Service

MSAMB has started a SMS service for dissemination of market information and intelligence. This is a joint initiative by MSAMB and Reuters, the internationally renowned news agency. This SMS service has
been started for farmers and others concerned so as to disseminate information about prices of agricultural commodities, weather forecast and market fluctuations as also provide crop advice and guidance for application of pesticides and fertilizers. It's a subscription-based service, wherein subscribers get commodity prices of three markets of their choice from a list of markets for each commodity. More than 75000 farmers have subscribed to this service. According to M L Lokhande, Manager IT, MSAMB, "The information is helping farmers in taking decisions with regard to selecting the right time to sell their produce and also clear doubts related to the appropriate use of manure and fertilizers for better crops yield". 
6.9 GOVERNMENT INFRASTRUCTURE INITIATIVES AT STATE LEVEL

Following table list the infrastructure initiatives showing e--Readiness of government of Maharashtra.

Table 6.2 State e -Readiness and details of existing Projects/initiatives

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Initiative</th>
<th>Description</th>
<th>Status /Reach / Other details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Directorate of Information Technology</td>
<td>Setu is a two tier application mainly operating at Collectorate, and Taluka places.</td>
<td>Setu centers have been setup at almost all the District Collectorates, and Tehsils offices</td>
</tr>
<tr>
<td>2</td>
<td>I-Setu (Integrated Setu)</td>
<td>I-Setu is a proposed project to be started in Mumbai, where by citizens can not only access government offices for do One –stop centre for delivering government services to the citizen (setu.maharashtra.gov.in) but also provide other services such making payments to various government agencies like Telephones, Electricity, Municipal Taxes and also non government agencies like Insurance, Air ticket etc.</td>
<td>Initially 50 such I-Setu centers are likely to be established in Mumbai city and later on will be established in rest of the cities</td>
</tr>
<tr>
<td>3</td>
<td>Government of Maharashtra Portal</td>
<td>A single point entry portal for the state of Maharashtra for providing government information online to both citizens and businesses (Maharashtra.gov.in)</td>
<td>The Portal will be integrated with a payment gateway to provide services</td>
</tr>
<tr>
<td>4</td>
<td>MSWAN (Maharashtra State Wide Area Network)</td>
<td>MSWAN is an initiative to establish broadband connectivity across the State of Maharashtra</td>
<td>The MSWAN is expected to be operational by March 2008 in most blocks</td>
</tr>
<tr>
<td>5.</td>
<td>SDC (State Data Centre)</td>
<td>A State Data Centre would be established at the State level housing all government applications</td>
<td>SDC is planned to be established along with the MSWAN</td>
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<td>6.</td>
<td>Official website of MTDC</td>
<td>The Government of Maharashtra has developed a Tourism website for the promotion of tourism in the State. Information regarding tourist destinations, room bookings, and tour guidance is available through this site</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Official website of Public Works Department</td>
<td>The Computerization of Public Works Department (PWD) has enabled to keep track of the enormous amount of projects and contractors at various stages of the project at different locations. The official website of PWD also offers various other facilities such as information about rest houses and availability of room, details about Road network in Maharashtra</td>
<td>Information about Public Works Department and the projects is hosted online</td>
</tr>
<tr>
<td>8.</td>
<td>Maharashtra State Agricultural Marketing Board website</td>
<td>MSAMB is having an important role in developing and coordinating agricultural marketing system in the State of Maharashtra. The website provides the market price of commodities</td>
<td>Online</td>
</tr>
</tbody>
</table>

(Directorate of Information Technology web site)

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