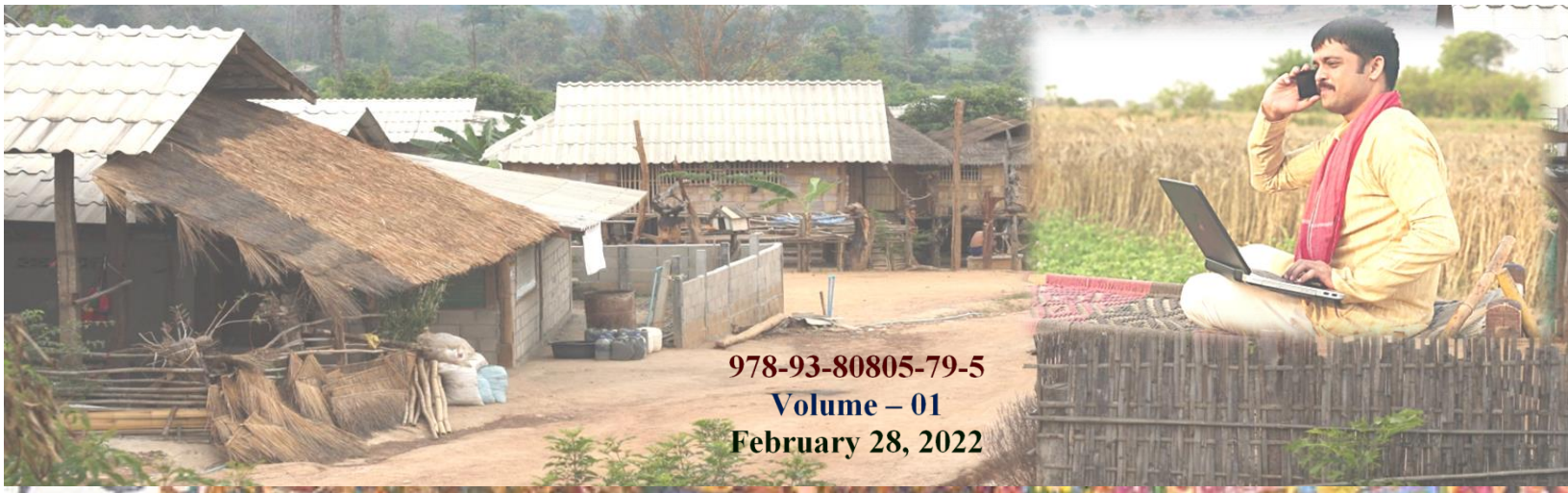
Rural India and Sustainable Development

Chief Editor

Dr Jitendra Singh Bhadauria



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RURAL INDIA AND SUSTAINABLE DEVELOPMENT

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From the Desk of Chief Editor……

Rural development aim is to maintain the quality of rural life that is the key factor of sustainable growth with effectiveness of the agricultural Development in grossroot level. To achieve required production and productivity in the rural areas there must be a spatial balance in the social, cultural and economic development. Economic and social development is considered an essential need for a society. The progress of rural development initiatives in the country depends on how well these programmes are reached in the section of society that is waiting to its development by welfare schemes to be launched by Government. Although in a top populous and diverse cultural country like India, development efforts do not fully reach to the masses due to lack of awareness about benefits of the programmes for sustainable rural development. Consequentially the result of rural welfare schemes are not able to achieved their objectives. Success of development programs is dependent on transparent implementation and participative approach of local involvement.

Community-driven rural development is the way to reach remote and vulnerable groups in India. Thus, community participation is essential so that intended beneficiaries could aware of the issues and problems on the ground level and can work toward their own betterment with the help of local Government. Empowerment of women is another important issue for social transformation and fast India's economic growth. When the pandemic struck, it disrupted lives and economies of the workers and rural families. Although it also opened up an economic opportunity for the women and rural population with under privileged background to manufacture pandemic preventive materials like masks etc and other economic activities with the support of Government.

Local participation and sustainable programmes create awareness among communities and tend to have beneficial effects of government welfare programmes. Working with communities to enhance awareness, knowledge and choices of work in village development programs is the way to go ahead for inclusive and sustainable development. Development of rural India is also interesting and attracting area of investment and employment generation for Government, corporate and civil society, NGO organizations etc. However the objectives remain partially fulfilled due to lack of community participation and local leaders devotion with honesty. Rural institutions remain constrained by lack of awareness about duty fullness and skillful work by employees. Only Government cannot fulfill rural need and development so a combined effort is required to bridge the gap between availability and achievement to make the nation developed with five trillion economies.

Prayagraj, 28 February, 2022

Dr Jitendra Singh Bhadauria
Chief Editor

CONTENT

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CHAPTER - 1

Rural Education Status in India

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1.1 Introduction

The system of education in rural areas has been undergoing many changes and transformations in the present existence there have been development and progression taking place in the system of education in rural areas but still much improvement need to be made and it is not at par with the urban system of education which developments taking place in the system of education in rural areas. The rural communities are able to recognize the significance of education and sustain their livelihoods better there have been develop of opportunities for adults as well as to enhance their educational skills and abilities.

The present chapter throws light on the present scenario of India about rural education. It also describes the need of rural education that is the foundation of rising India. The chapter covers the schemes run by government of India for improvement of status of rural education as well as author discuss some solutions to get rid of the problem of rural education.

The word "Education" is derived from Latin word ***"Educatum"*** which means to train, to raise or to simplify it further, ***"E"*** means from inside and ***"Duco"*** means to draw out. The other Latin words which are supposed to be the root words ***"Educare"***. *Educare* and educere also mean to bringup, to lead out or to develop education is a life-long process of growth and development such education is not confined to the limits of time' place and individual any person who provides another person with new experience is a teacher and the place where giving and receiving of such experiences takes place can be turned as a school.

"Education is the most powerful weapon which you can use to change the world"

We can say that Education is to acquire the present-day wisdom. Literate and educated people are a pre-requisite for both preserving and developing the society to change."

Education as Per Other Thinkers

"Education is a process of training man to fulfill his aim by exercising all the faculties to the fullest extent as a member of society. "

Aristotle

"Education is the manifestation of divine perfection already existing in man."

Vivekananda

"Education means to enable the child to find out ultimate truth making truth its own and giving expression to it."

Rabindranath Tagore

"Education is a process for training of hand' head and heart. It is all round drawing the best in child's to man's body 'mind and soul"

Mahatma Gandhi

Education also means helping people to learn how to do things and encouraging them to think about what they learn it is also important for educated to teach ways to find and use information through education the knowledge of society country and of the world is passed on from generation to generation.

In democracy is through education children and adults are supposed to learn how to be active and effective citizens more specific education helps and guide individuals to transform from one class to another in power individual societies countries by education are taking and age over individual stand on the bottom pyramid of growth.

1.2 Types of Education

Education goes beyond what takes places within the four walls of the class room. A child gets the education from his experiences outside the school as well as from those within on the basis of these factors. There are three main types of education, namely Formal, Informal and Non-formal.

1.2.1 Formal Education

Formal education or formal learning usually takes place in the premises of the school, where person may learn basic, academic, or trade skills. Small children often attend a nursery or kinder garden but often formal education begins in elementary school and continues with secondary school. Post education (or higher education) is usually at a college or university

which may grant an academic degree. It is associated with a specific or stage and is provided under a certain set of rules and regulations.

1.2.2 Informal Education

Informal education maybe a parent teaching a child how to prepare a meal or ride a bicycle people can also get an informal education by reading many books from library or educational websites. Informal education is when you are not studying in a school and do not use any particular learning method. In this type of education, conscious efforts are not involved. It is neither pre-planned nor deliberate. It may be learnt at some marketplace, hotel or at home

1.2.3 Non Formal Education

Non formal education Includes adult basic education adult basic education, adult literacy educational or School equivalency preparation. In non formal education, someone (who is not in school) can learn literacy, other basic skills or job skills. Home education, individualized instruction such as programmed learning, distance learning and computer-assisted instruction are other possibilities.

Non formal education is imparted consciously, deliberately and systematically implemented. It should be organized for a homogeneous group. Non-formal, education should be programmed to serve the needs of the identified group. This will necessitate flexibility in the design of the curriculum and the scheme of evaluation. Here we will be discussed about rural education or urban education.

1.2.4 Rural Education

The way to improve the present scenario of education in rural India is the construction of schools in every village, providing proper and adequate infrastructure and other resources, using modern technologies in education, creating awareness about the importance of education and rights. Education is the means to acquire the present day wisdom. In rural India, access to education in various spheres such as social, political economic, scientific and others can act as a catalyst to change.

In today's rural India, many castes have successfully utilized education to break through social and cultural norms associated with their castes and have also helped in their economic betterment.

1.2.5 Urban Education

It is a method of schooling that takes place in larg, densely populated areas with diverse populations. It can refer to the situations and demands that characterize teaching and learning in large metropolitan areas. Schools that offer an urban education experience usually have a high enrollment rate and a complex bureaucratic system. Urban education refers to a mode of learning and teaching that mainly takes place in urban areas.

Three types of urban education are 'urban intensive', 'urban emergent' and 'urban characteristic'. Urban intensive schools are those concentrated in large metropolitan cities such as New York .Urban emergent schools are in large cities but not as large as major cities they also have similar resources and academic development of students relative to urban intensive schools .Urban characteristics schools aren't in big cities and are only just beginning to experience challenges associated with urban contexts.

1.3 Differences between Urban and Rural as System of Education

The difference between urban and rural students are not in terms of intellect but due to their surroundings environment, learning ability, availability of infrastructure, skills and access to different facilities considering these factors the curriculum for rural students must be created.

- Computer education is given high importance in urban areas whereas very few schools in villages give computer training.
- School education in urban areas is more advanced specially since there is a lot of computer added teaching.
- Basic amenities like no drinking water are provided in some of the schools in villages.
- Apart from the course curriculum rural schools are not able to involve children in other activities like sports, co-curricular activities and competitions.
- Level of education in urban schools is for advanced as compared to the basic level taught in rural schools. Such events and activities tend help in the overall development of the children.

1.4 Education in Rural Areas

Literate and educated people are a prerequisite for both preserving and developing the society. In rural India access to education in various spheres such as social, political,

economic and scientific others can act as a catalyst to change. In today's rural India many castes have successfully utilized education to break-through social and cultural norms associated with their caste and have also helped in their economic betterment.

There are few factors that are influencing the progress of the educational system in rural areas. These are increased in the demand for the first weight pre-primary education for the children and families in rural areas. They are aware of the situations in the developing part of the country and this is the main reason that they have recognize the significance of education and express willingness in educating them their children.

There is a need for the system of education in rural areas to match with the system of education in urban areas. There have been establishment of schools and training centers in rural areas which have lead to improvements in the living standards of the individuals these standards have enable the rural communities to be at par with the urban communities allocations to achieve the objectives of the right to education which has been aligned with **Sarva Shiksha Abhiyan**.

1.4.1 Objectives of Rural Education

- To provide co-ordination at the National level for rural education program and activities.
- To provide leadership for rural education related conferences and workshops
- To provide a forum for all those involved in Public education in rural areas including teachers, administrators, board members and member of the rural community at large whereby they may come together professionally and exchange ideas
- To promote state, regional and local delivery systems which bring about efficient and effective education for children in rural areas
- To stimulate discussion, research and policy development regarding equal educational opportunities for all students

1.5 Need for Education in Rural Areas

It is important to understand the need for good quality education in rural areas, as it helps keep rural areas populated. Young people move to urban areas for better opportunities in education and employment, improved rural education is one possible strategy for keeping them in rural areas. It was recently documented that 69% of India's population lives in rural areas. Quality education is a pertinent tool for enhancing quality of life, creating awareness

and capability, increasing freedom and improving overall holistic human development for the people and the nation.

Education is considered vital element in the development of society, a system and a country. The Author convinced that a well supported, easily accessible education system is an efficient means to make people economically conscious and thereby make them actively participate in their economic prosperity and cultural development. As an educator The Author insist that education should be given.

The education system should be structured in such a way that it helps to realize the objectives of the foundation fathers of Indian Constitution. India, being the land of village, rural education should be so formulated that it would adapt to the needs of creation of new and higher type of rural society as envisaged in the Constitution.

1.5.1 Elements of Rural Development

In the long term education in a rural setting should be focused on making rural people responsible for their participation in the following elements of rural development

- **Employment and Income Opportunities**

Increasing the quality of education in rural areas can significantly impact the development of employment opportunities. Studies have shown that the availability of skilled labour, transportation infrastructure and local markets are prime factors in selecting a community for an industrial placement.

- **Increase in Productivity of Rural Labour Force**

Education can improve labour productivity in rural areas, increasing the wealth of a region or area. Labor productivity is largely driven by investment in capital, technological progress, and human capital development. Business and government can increase labor productivity of workers by direct investing in or creating incentives for increases in technology and human or physical capital.

1.5.2 Education Develops Leadership

With education, individuals gain confidence, knowledge, skills and experience - all factors that increases and individual's ability to actively and efficiently lead a group of people towards success. Education helps to identify and develop those leaders in our communities

who will battle against low - quality education and poverty leading to a successful and strong community.

To conclude, education plays a critical role in rural development, as it is a key factor in developing the people of the rural area, the community and the land itself. With education, there is always a bright future in store for rural communities. As a student and educator, the authors believe that the past shows us that education is an important factor in bringing about development in any country.

1.5.3 Educational Programs taken by the Indian Government in Rural Areas

A) Non Formal Education Schemes

The Non Formal Education scheme (NFE) was introduced in 1979 -80 by the central government to support the formal system in providing education to all children below the age of 14 years. This scheme was focused especially in the educationally backward districts of Andhra Pradesh, Assam, Bihar ,Himachal Pradesh, Jammu and Kashmir, M.P. , Orissa, Rajasthan, Uttar Pradesh and West Bengal from 1987-88. The scheme was introduced because the National Policy of Education (NPE) had recognized that the formal schooling system could not reach all children.

Therefore a large and systematic program of non formal education would be required to educate the school dropouts and children from habitations, where no schools are present, working children and girls, who could not attend whole day schools. The NFE scheme is run by the state governments, which set up NFE centers. The scheme, however, can provide grants to Voluntary Agencies (VAs) which can run this NFE centers on behalf of the governments. The Programme of Action (POA) 1992 has developed strategies of for running the NFE scheme and they are as follows:

1) Setting up of NFE centers based on a micro-planning exercise carried out for Universal Elementary Education.

2) Community participation by involving them in setting up the centre, identification of instructor and supervision of NFE centre.

3) Efforts to evolve different models of NFE programme for different target groups.

4) Adequate training and orientation of NFE instructors.

5) Linking the formal School to facilitate lateral entry of the learners from NFE stream.

6) Efforts to link non- formal courses with formal schools.

7) Adoption of learner-centered approach in such a way that the learning levels for the learners are equivalent to the formal system.

B) Operation Black Board

The scheme Operation Blackboard was launched in 1987 in pursuance of National Policy of Education Programme of Action, to provide minimum essential facilities to all primary schools in the country. This is a large operation and was launched after the external evaluation of the scheme had indicated that lack of training of teachers in using the teaching material and lack of uniform facilities which are provided without modification, according to local needs were found to be some of the drawbacks of implementation of the scheme. The operation blackboard scheme contains the following three sub schemes:

1) Continuation of ongoing Operation Blackboard to cover all the remaining Primary School, especially those in Scheduled Caste or Scheduled Tribes areas.

2) Expanding the scope of Operation Blackboard to provide three teachers and three rooms to primary schools wherever enrollment warrants; them.

3) Expanding Operation Blackboard to upper primary schools to provide the following :

- At least one room for each classroom or section
- A headmaster- cum- office room
- Separate toilet facilities for girls and boys
- Essential teaching learning equipment including a library
- At least one teacher for each classroom or section
- A contingency grant for replenishment of items consumable and minor repairs etc.

The Scheme plan to take the following measures to improve the quality of education:

1) Teachers will be trained in using the teaching materials under a specially designed teacher training programme.

2) State governments will make a provision for breakage and replacement of equipment.

3) Enough flexibility will be provided for purchase of teaching- learning needs, relevant to the curriculum and the local needs of the schools.

4) To appoint women for at least 50% of teacher posts, so that a positive impact can be created on girls enrollment and retention.

5) As far as possible, low cost and locally available designs relevant to the local conditions have to be adopted for school building. Nirmithi Kendra (Building centers) and local technical institutes will be associated in this endeavour.

The financing of this scheme is divided between the central government and the state government. The central government will provide funds for equipment and teachers' salary, whereas the state governments have to mobilize resources under Jawahar Rozgar Yojana for construction of school buildings and other facilities. The state governments are also supposed to provide contingency and replacement funds for equipment.

C) Mahila Samakya (MS)

Mahila Samakya, a scheme that aims at education for Women's Equality was launched in 1989, in pursuance of the goals of the New Education Policy 1986 this scheme tries to emphasize on education as an agent of change' in the status of women. The programme was originally started in 10 districts of Karnataka, Gujarat and Uttar Pradesh with the assistance from the Netherlands and was later extend to Andhra Pradesh and Kerala. The programme was conceived as a women's empowerment programme for socially and economically marginalized women. It focus is on rural women.

Core components of the Mahila samakhya organisation approach are as follows:

- The role of women functionaries at village level is highlighted. They have to assist in group formation and provide issue specific knowledge to these groups. Activities to be conducted are chosen in context of their potential impact on the lives of women and in response to the articulated local demands
- Formation of women collectives at village level (Sanghas)
- Taking a collective social action
- The creation of resource agency is at the district and state level
- Conducting exposure visit of the women, facilitating issue-based learning for the grassroots women
- Intervention at the political level (village, district and state level)
- Non-negotiable principles like allowed women, sufficient time and space to come together plan at reflect and determining their own development.
- A process-driven rather than target- driven approach.

These groups although have undertaken a number of activities, have failed in creating critical mass of opinion as the program outreach is limited to only few villages. However in recent years Sanghas are coming together as federations and the role of Mahila Samakhya or the central organization has changed into one of specialist supporting these Federations.

D) District Primary Education programme

District Primary Education Pro-gramme (DPEP) was launched in November 1994. This programme was launched to operationalise the strategies to achieve Universal Elementary Education at the particular district level, rather than imposing the same rule, i.e., educational pro-grammes were decentralized through this scheme. It emphasizes on decentral-ized management, community mobilization, and district-specific planning based on contextual and research-based inputs available to each district. The basic objectives of this programme are as follows:

a) To provide all children with the access to primary education, either in the formal system or through Non-Formal Education (NFE) programme.

b) To reduce differences in enrolment, dropout rates and learning achieve-ment among gender and social groups to less than 5 percent.

c) To reduce the overall primary dropout rates for all students to less than 10 percent.

d) To raise average achievement levels by at least 25 percent over measured base line levels and ensuring achievements of basic literacy and numeracy competencies and a minimum of 40 percent achievement levels in other competencies by all primary school children.

E) Samgra Shiksha

Samagra Shiksha is a programme in the school education sector that extends from pre-school to class XII. This scheme is prepared with a broader goal of improving school effectiveness measured in terms of equitable learning outcomes and equal opportunities for schooling. The Samagra Shiksha scheme contains the three Schemes of Sarva Shiksha Abhiyan (SSA), Teacher Education (TE) and Rashtriya Madhyamik Shiksha Abhiyan (RMSA). This scheme is launched for leveraging technology to manage and enhance efficient implementation of the centrally sponsored Integrated Scheme for School Education. The Objectives of Samagra Shiksha is given below

- Providing quality education and enhancing the learning outcomes of students.
- Bridging the gender and social gaps in school education.
- Ensuring inclusion and equity at every level of school education.
- Supporting states to implement the right of children to compulsory and free education under the Right to Education Act, 2009.

- Promotion of vocationalisation of education.
- Ensuring basic minimum standards in schooling provisions.
- To strengthen and upgrade State Institutes of Education or SCERTs and DIET as nodal agencies for teacher training.

F) National Program of Nutritional Support to Primary Education (School Meal Program)

The government of India initiated the National Programme of Nutritional Support to Primary Education (NP-NSPE) on 15 August 1995. The objective of the scheme is to help improve the effectiveness of primary education by improving the nutritional status of school children.

The scheme aims primarily at in-creasing enrolment, retention and attendance of students in primary classes by supplementing nutritional requirements of children attending these primary schools. The purpose of this scheme was to provide hot cooked meal to children of primary and upper primary school students as well encouraging poor children & belonging to disadvantaged sections to attend school more regularly and help them concentrate on classroom. It is an ambitious scheme that has been operationalized throughout the country in a very short period. The scheme provides for nutritious and wholesome cooked meal of 100 gms of food grains per school day, free of cost, to all children studying in classes I to V.

The scheme has registered a rapid growth in school enrolments and also retention of students. The attendance of students also increased because many parents send their children to schools in the hope that they will get at least one full meal in a day. The scheme has become fully operational from 1997-98, covering nearly 110 million children in primary classes. The drawback of this scheme is that in many schools, the children attend the classes only till the meals are served. Once the meals are served, they tend to leave the school. To overcome this problem, in many schools the classes are now conducted during the morning hours and the meals are served only to those students, who attend the schools on that particular school-day and not to all those, who have enrolled in the school.

G) Sarva Shiksha Abhiyan (SSA)

The Sarva Shiksha Abhiyan launched in March 2002, is a time-bound integrated approach, where the central gov-ernment and the state government together will implement this scheme in partnership with the local governments and community. The scheme aims to provide useful and quality elementary education to all children between 6 and 14 years age

group by 2010. The Sarva Shiksha Abhiyan is an effort to recognize the need for improving the performance of the school system and to provide community-owned quality elementary education as a mission. The scheme also envisages bridging gender and social gaps that exists in our coun-try today.

H) Community Mobilization and Participation Schemes

Many educational innovations of recent years are based on strong foundation of community support and participation. When the progress is discussed and analyzed at different levels within the project, 'people's acceptance and participation' is used as an indicator. The government with the assistance of some Non-Governmental Organizations and other philanthropists has started some schemes which mobilize the village community to take responsibility to ensure quality education for every child in the village.

Problems of Rural Education in India

In India the right to education is a fundamental right which states that every citizen of India between the ages of 6 to 14 years gets free and compulsory education. This provision ensures that every citizen of India should get education up to 14 years without any discrimination but the reality is far different from this.

The literacy rate in India is 77.7%. However, the literacy rate of Urban region in India is 87.7% whereas in rural India it is only 73.5%. There are many reasons behind the difference between these two. Nearly 65.53% populations of India reside in a rural area. There is a wide gap between urban and rural education system. The literacy rate of the urban area and the rural area are also wide.

According to ASER report, the survey was conducted and cover almost all rural districts; it was found that more than 50% of the children of age 3 to 16 years are not able to read and perform arithmetic abilities in the age group of 5to 16 years. However, the problems related to education in rural India are:

a) Lack of availability of resources
b) Lack of awareness of educational importance
c) Less availability of schools
d) Digital dividend
e) Financial condition

- **Lack of Availability of Resources**

There is a lack of availability of resources in the rural regions in India. There is also a lack of infrastructure in the schools situated in rural areas - no availability of benches, playgrounds, laboratories, washrooms or if present they are in the worst condition. Drop rates in rural areas many children drop out of school to support their families, poverty is a massive factor in rural students absent due to child marriage and lack of washrooms the rate is even higher among female children. Sometimes the text books are not available in proper quantity or if available they are not in good condition.

The availability of stationery is also a challenge. Many rural Indians don't have enough money to bear stationary charges and other expenses. Another challenge is there is no transportation availability as there is poor connectivity from one place to another place. Another challenge is less availability of teachers. In India the school in rural areas has only one or two teachers in the schools.

- **Lack of Awareness of Importance of Education**

Lack of awareness of the importance of education another reason for the low literacy rate in rural regions in India is the lack of awareness of the importance of education. People in rural regions are mostly engaged in agricultural and allied sectors. Children from the beginning are engaged in these sectors and not give much importance to their studies. Religious belief and some societal norms is also a hiccup in the path of providing education in rural India. Many rural Indians believe that children especially girls should not study much and don't have to cover a long distance to go to school. Instead of getting the education, they should focus on some work which helps them in earning.

- **Less Availability of Schools**

There is also less availability of schools in rural regions. Many students have to go from one place to another village by covering miles of distance. Another challenge is the non availability of transport. It takes long hours to reach school and to come back home. This challenge also aids in increasing drop-out student ratios in rural India.

- **Digital Dividend**

Another challenge in rural education in India is the Digital dividend. In a globalised world, where everyone is technology prone and using their application in daily life. It is necessary

that everyone should have knowledge about their use. During the corona time education is given in online mode but due to poor connectivity rural children are not able to get an education. This also creates a barrier in the education of rural India. Some of them also don't have a smartphone due to which they can't access education.

- **Financial Condition**

Another reason for lack of education is that people of rural India don't have much income so they can't afford high school fees and eventually drop-out the school. Children have limited or no access to basic learning tools such as well-equipped classrooms, computers, labs, playgrounds, among other things. Often, the teachers are often not qualified or do not turn up, leading to a poor quality of education

1.6 Ways to Boost Rural Education in India

In rural areas, many children drop out of school to support their families. Poverty is a massive factor in rural student absenteeism. Due to child marriage and lack of washrooms, the rate is even higher among female children. This has brought in an imbalance between the ratio of educated males and females in the locality. We need to overcome the above said obstructions to boost education in India. In order to boost this, we need to adopt the following meaures :

1) Encourage Free Education

One of the most important ways to boost rural education is boosted up free education as our constitution provides the right to education to all citizens of India. The government should focus on how they can increase the enrollment of children who reside in rural areas. This can be done by establishing more schools, providing proper infrastructure and resources. The government should also ensure that the number of children who are attending school must retain education up to elementary level. Another reason for encouraging free education is that people of rural India don't have much income so they can't afford a school fees and drop out the school.

2) Increase the number of Schools and Established More School

The government should set up more school in rural India to boost up education. Most of the children have to leave their education due to the large distance between the home and the school. This is the case, especially for girls. Most of the girls drop out of school due to non

availability of transport. If the schools are set up at every village it will aid in increasing the enrolment percentage and decrease the dropout rate of rural children.

3) By adopting Modern Teaching Technologies

Modern technologies are very important in imparting education. Today in a globalised world where technology is rapidly emerging, it is necessary for every individual that they are updated with the current technology. Also the focus of education should be on conceptual learning not on rote learning so that the students must use the applications of these new technologies.

4) By providing scholarship

This can be done by providing free education for needy students. Government launched many Scholarship plans every years for development of all students..

- Scholarship for categories (SC, ST, OBC etc)
- Mid-day meal
- Laptop distribution
- Cycle distribution
- Free stationeries distribution
- School uniform distribution
- Hostel facilities for girls and boys

5) Proper infrastructure and quality ability resource (work on school infrastructure)

6) Bring innovative teaching methods.

7) Remote computer literacy.

1.7 Present Scenario of Rural Education in INDIA

Right to education is the primary right of every citizen of India, whether a child resides in a high-profile society or in a faraway not so developed scheduled village. In India the condition of rural education is still improving the conditions of these rural schools are still very poor. There are very few schools in the rural areas and children have to travel far away distance to avail these facilities and most schools in these locations do not provide drinking water. The quality of education is also very poor the teachers get very less income, so most of the time the teachers are either absent or they do not teach properly.

1.7.1 Education in Rural Areas of India - The Preamble

The Preamble of the constitution States that are democratic society based on justice, social, economic and political liberty- of thought, expression, belief, faith and worship and equality- of status and opportunity has to be formed. The constitution also aims at promoting among all the citizens 'Fraternity, assuring the dignity of the individual and unity of the Nation. For realization of such an objective, it is necessary that the conception and the program of education should be in harmony with and be derived out of it.

Rural education should be so formulated that it would adapt to the needs of creation of new and higher type of rural society as and we said in the constitution for broad-based sustainable economic development. Educating communities means developing schools and educating children and leaders. By doing so rural communities will lead to a healthier and more sustainable future. An education system in rural communities has the opportunity to build capacity and knowledge in the rural populace, helping them to make informed decisions about their farms and to innovate in agricultural affairs. Education also exposes the masses to information. Education can lead to many positive outcomes such as an improved ability to understand policies, procedures, rights, duties, government schemes, legislation, available benefits and protection laws. It is important to understand the need for good quality education in rural areas. In India, education in the rural segments is not only important to eradicate poverty and illiteracy, but also for a variety of other social, economic as well as cultural and political reasons.

1.8 Conclusion

The literacy rate of India is 70 7.7 % but it is different in rural and urban India. There is a wide gap between the literacy rate of Urban and rural India. However the reason behind the low literacy rate in India is many. The problems faced by rural India in achieving the education are less number of schools and resources, less availability of teachers, religious and societal norms the large distance between the school and home lake of awareness education. The way to improve the present scenario of education in rural India is the construction of schools in every village, providing proper and adequate in infrastructure and other resources, using modern technologies in education, creating awareness about the importance of education and rights. In India, education in the rural segments is not only important to eradicate poverty and illiteracy, but also for a variety of other social, economic as well as cultural and

political reasons. The role of education, both urban and rural is huge in growth of the country's economy. Although education in the urban areas have progressed rapidly during the last few decades there are still some villages where education is not given sufficient priority. Even though the government is working to improve the state of education in the country there is a still a lot to be improved. There is a growing awareness among people above education; however the lack of infrastructure is being a major obstacle which needs an active intervention of the government.

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CHAPTER - 2

ICT initiatives for School & Primary Education in Rural India

(With Special Reference to improve Learning outcomes)

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2.1 Introduction

Education is a tool through which we can change the world (Nelson Mandela). Education plays an important role in the progress of an individual's mind and country. People are made aware of what is going on in the world and can understand these issues and take necessary measures, if they are educated. Education tames the astray mind, nurturing its capabilities the same way, training builds a clever dog. Right to Education is the primary right of every citizen of India, whether a child resides in a high profile society or in a faraway not so developed secluded village, according to the Article 45 of Indian Constitution the basic elementary education must be provided to all the children up to the age of fourteen years. The Constitution (Eighty-sixth Amendment) Act, 2002 inserted Article 21-A in the Constitution of India to provide free and compulsory education of all children in the age group of six to fourteen years as a Fundamental Right in such a manner as the State may, by law, determine.

The Right of Children to Free and Compulsory Education (RTE) Act, 2009, which represents the consequential legislation envisaged under Article 21-A, means that every child has a right to full time elementary education of satisfactory and equitable quality in a formal school which satisfies certain essential norms and standards. Article 21-A and the RTE Act came into effect on 1 April 2010. The title of the RTE Act incorporates the words 'free and compulsory'. 'Free education' means that no child, other than a child who has been admitted by his or her parents to a school which is not supported by the appropriate Government, shall be liable to pay any kind of fee or charges or expenses which may prevent him or her from pursuing and completing elementary education. 'Compulsory education' casts an obligation on the appropriate Government and local authorities to provide and ensure admission, attendance

and completion of elementary education by all children in the 6-14 age group. With this, India has moved forward to a rights based framework that casts a legal obligation on the Central and State Governments to implement this fundamental child right as enshrined in the Article 21A of the Constitution, in accordance with the provisions of the RTE Act.

Table 2.1 : Literary Rate Urban Vs Rural

S.No	States	Rural Literacy Rate			Urban Literacy Rate		
		Male	Female	Average	Male	Female	Average
1)	Andhra Pradesh	67.5	53.4	60.4	86.3	73.1	79.6
2)	Assam	89.4	79.9	84.9	96.1	91.4	93.8
3)	Bihar	78.6	58.7	69.5	89.3	75.9	83.1
4)	Chhattisgarh	84	65.6	75	91.8	82.3	87.2
5)	Delhi	----	-----	-----	94.1	83.4	89.4
6)	Gujarat	85.7	68	77	95.2	86.3	91.1
7)	Haryana	85.8	66.4	77	92.5	81.2	87.3
8)	Himachal Pradesh	92.3	79.2	85.6	97.8	93	95.5
9)	Jammu & Kashmir	84.9	66	75.8	88.5	75.7	82.6
10)	Jharkhand	80.6	61.4	71.4	92.6	78.6	86.1
11)	Karnataka	78.2	63.1	71	92.5	83.7	88.3
12)	Kerala	96.7	94.1	95.4	98.2	96.4	97.3
13)	Madhya Pradesh	77.9	61	69.8	91.4	79.5	85.8
14)	Maharashtra	87	71.4	79.4	95.3	87.6	91.7
15)	Odisha	82	67.3	74.9	94.4	85.9	90.2
16)	Punjab	85.5	74	80	93.8	86.7	90.5
17)	Rajasthan	77.6	52.6	65.5	91.1	74.6	83.5
18)	Tamil Nadu	84.2	70.8	77.5	92.3	85.9	89
19)	Telangana	70.6	53.7	62.1	91.7	79	85.5
20)	Uttarakhand	93.1	79	86.1	97.4	85.9	92
21)	Uttar Pradesh	80.5	60.4	70.8	86.8	74.9	81.2
22)	West Bengal	82	72.6	77.4	91.4	84.7	88.1
	All-India	**81.5**	**65**	**73.5**	**92.2**	**82.8**	**87.7**

Even after 64 years of independence some States in India are still struggling to achieve Universal enrolment, retention and quality education. There are about 1303996 or more than one million rural schools among 6, 38,000 villages in India. Schools in rural areas are promoted to raise the level of education and literacy in rural India. The main aim of running

these types of schools in India is to increase the rate of literacy in rural areas. More than 40 percent of India's population is illiterate and cannot read or write. Schools in rural areas are inadequate and often equivalent to being non-existent. Thus, government's initiative to set up schools in rural areas came into picture.

India is a rapidly changing country in which inclusive, high-quality education is of utmost importance for its future prosperity. The country is currently in a youth bulge phase. It has the largest youth population in the world—a veritable army of 600 million young people under the age of 25. Fully 28% of the population is less than 14 years of age, and with more than 30 babies being born every minute, population growth rates are expected to remain at around one percent for years. India is expected to overtake China as the largest country on earth by 2022 and grow to about 1.5 billion people by 2030 (up from 1.34 billion in 2017).

With 1.2 billion people, India is the second largest country by population and the largest democracy in the world. India's GDP of $1.946 trillion makes it the 10th largest economy in the world (IMF) and with a GDP growth rate of 5.6% (2012–13). It is one of the fastest developing nations. It is a well established fact that education plays a vital role in nation building and having literate, well informed citizens is essential for the nation's betterment. Literacy and educational attainment have long been acknowledged as important indicators of a country's development, as they not only nurture personal development but determine employment and opportunities for overall human and social development as well.

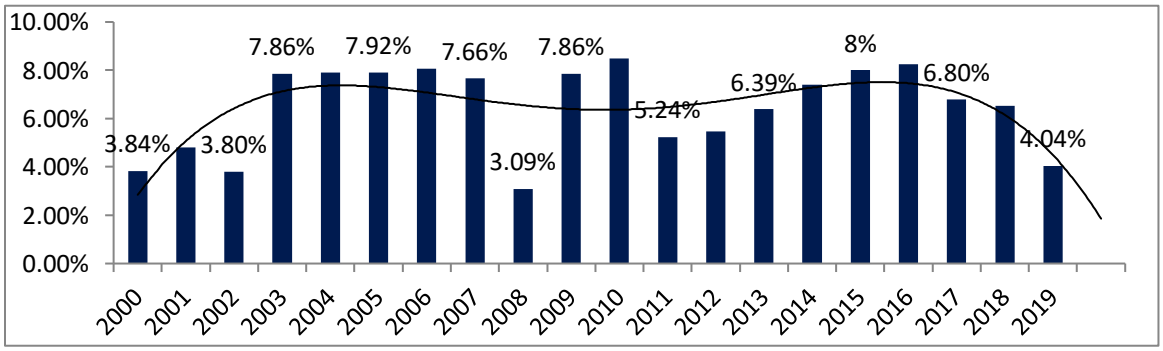

Figure 2.1 : GDP Growth (Annual %) - India

Hence, to sustain the current rate of development, India needs to provide its large population with quality education. In this scenario, the United Nations has reported that India houses the maximum number of illiterate adults i.e a world staggering 287 million, a number that is nearly four times the population of France. Clearly, educating the masses is

one of the biggest challenges India needs to overcome. The 7th All India Education Survey conducted by the National Council of Educational Research and Training (NCERT) under the Ministry of Human Resource Development (MHRD), Government of India has revealed some startling facts about the state of education in India. Some of them are:

- 50% of Indian children aged 6–18 do not go to school
- A little over one-third of all children who enrol in class Ireach class VIII.
- In India, only 53% of habitation has a primary school and only 20% of habitation has a secondary school.
- On an average, there are less than three teachers per primary school. They have to manage classes from I to V every day. In rural north India on an average day, there is no teaching activity in about half of the primary schools
- Dropout rates increase alarmingly in classes III to V, its 50% for male students and 58% for female students.
- The main reasons given by every 3 out of 4 student drop-outs are: a) High cost of private education b) Need to work to support family members and c) little interest in studies.

Table 2.2 : Top 10 Rank State of GDP (in Rs. Crores), Poverty and Literacy

Rank	State/Union Territory	GDP ₹ Lakh crore	Literacy Rate Rank	Population Living Below the National Poverty (%)
1	Maharashtra	₹32.24 lakh crore	21	13
2	Tamil Nadu	₹22.44 lakh crore	31	09
3	Uttar Pradesh	₹17.05 lakh crore	35	20
4	Gujarat	₹16.48 lakh crore	12	14
5	Karnataka	₹16.29 lakh crore	17	18
6	West Bengal	₹13.54 lakh crore	36	16
7	Rajasthan	₹10.21 lakh crore	29	12
8	Andhra Pradesh	₹10.19 lakh crore	02	06
9	Kerala	₹9.78 lakh crore	18	02
10	Telangana	₹9.78 lakh crore	32	29

Most of these problems are being faced in rural India which still houses 72% of India's population. Lack of basic infrastructure, low involvement of the private sector, less than required Government support are the major issues plaguing education in rural areas of India. Leaving aside this factual data, initial visits to some schools in the remote areas of the state of Gujarat, western India led to some unnerving observations. Close to 80% students of class VIII [i] could not identify the difference between the alphabet letters “B” and “D”. They could not read or write simple three/four letter words in English. A maiorit of them could not answer simple questions like “What is this?” 50% of the allotted school time was spent by children idling around outside the classroom due to the absence of a teacher in the class. Clearly, children in rural areas of India are being deprived of quality education. Almost half of the country's population is below 25 years. Equipping these young people with both knowledge and skills would drive India's entrepreneurial and competitive spirit and make it into a global power.

2.2 Steps taken to Improve Quality of Education in Rural Areas

The Government of India has launched Samagra Shiksha - an Integrated Scheme for school education, w.e.f. 2018-19, which is an overarching programme for the school education sector extending from pre-school to class XII and aims to ensure inclusive and equitable quality education at all levels of school education. It envisages the ‘school’ as a continuum from pre-school, primary, upper primary, secondary to senior secondary levels and susbsumes the three erstwhile centrally sponsored schemes i.e. Sarva Shiksha Abhiyan (SSA), Rashtriya Madhyamik Shiksha Abhiyan (RMSA) and Teacher Education (TE).Bridging gender and social category gaps at all levels of school education is one of the major objectives of the scheme. The scheme reaches out to girls and children belonging to Scheduled Caste (SC), Scheduled Tribe (ST), minority communities and transgender.

The scheme also gives attention to urban deprived children, children affected by periodic migration and children living in remote and scattered habitations. Under the scheme, provision has been made for giving preference to Special Focus Districts (SFDs), Educationally Backward Blocks (EEBs), LWE affected districts, and aspirational districts while planning interventions like setting up of primary schools, upper primary schools, construction of additional classrooms, toilets, Kasturba Gandhi Balika Vidyalayas (KGBVs). The Samagra Shiksha scheme supports States for strengthening of school infrastructure including in rural

areas. The scheme provides for infrastructural strengthening of existing government schools based on the gaps determined by Unified District Information System for Education (UDISE) and proposals received from respective States/UTs. The scheme also provides for annual maintenance and repair of existing school buildings, toilets and other facilities to upkeep the infrastructure in good condition.

Samagra Shiksha focuses on improvement in quality of education by providing support for different interventions like in-service training of teachers and school heads, conduct of achievement surveys at state and national level, composite school grant to every school for providing a conducive learning environment, grants for library, sports and physical activities, support for Rashtriya Avishkar Abhiyan, ICT and digital initiatives, School Leadership development programme, remedial teaching for academically weaker students, support for Padhe Bharat Badhe Bharat, etc. Besides, the following are some of the steps taken to improve infrastructure and the quality of primary education:-

- Since the inception of the erstwhile Centrally Sponsored Scheme, Sarva Shiksha Abhiyan, in 2001 till 31.03.2018, construction of 3.12 lakh school buildings, 18.87 lakh additional classrooms, provision of 2.42 lakh drinking water facility, construction of 3.95 lakh Boys' toilets, 5.18 lakh separate girls' toilets and 1.41 lakh CWSN toilets have been sanctioned to States and UTs, out of which States and UTs have reported construction of 2.94 lakh school buildings, 18.03 lakh additional classrooms, provision of 2.35 lakh drinking water facility, construction of 3.76 lakh Boys' toilets, 5.07 lakh separate girls' toilets and 1.21 lakh CWSN toilets.

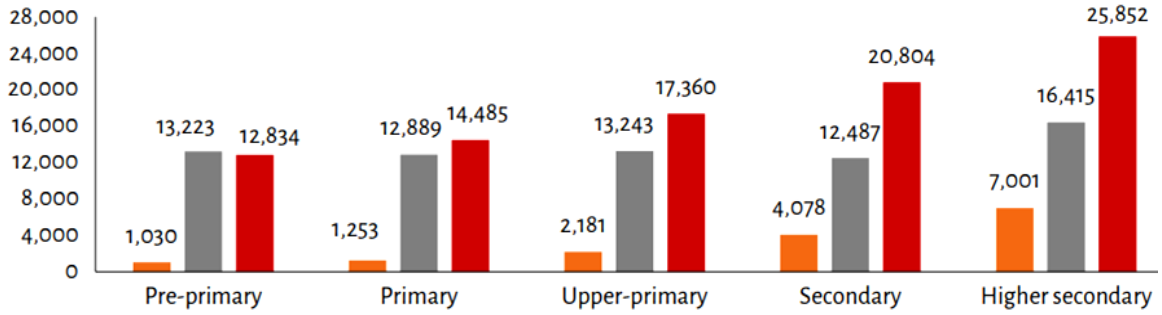

Figure 2.2 : Average household expenditure per-student attending government schools increased from `1,253 in primary to `7,001 in higher-secondary during 2017-18

- The Central rules to the RTE Act, 2009 have been amended on 20th February, 2017 to include reference on class-wise and subject-wise learning outcomes, which have

accordingly been finalised for all subjects upto the elementary stage and shared with the states and UTs.

- National Achievement Survey for classes 3, 5 & 8 based on Learning Outcomes was conducted on 13th November, 2017 to enable States & UTs to identify gaps in learning outcomes at district level and design strategies to address these gaps.
- Section 23(2) of the RTE Act has been amended to extend the period of training of untrained in-service elementary teachers to 31st March, 2019.
- The National Institute of Open Schooling (NIOS) has been entrusted to conduct this training through Open and Distance Learning (ODL) mode. The online D.El.Ed course has been started from 3rd October, 2017. More than 13 lakh teachers have joined these courses.

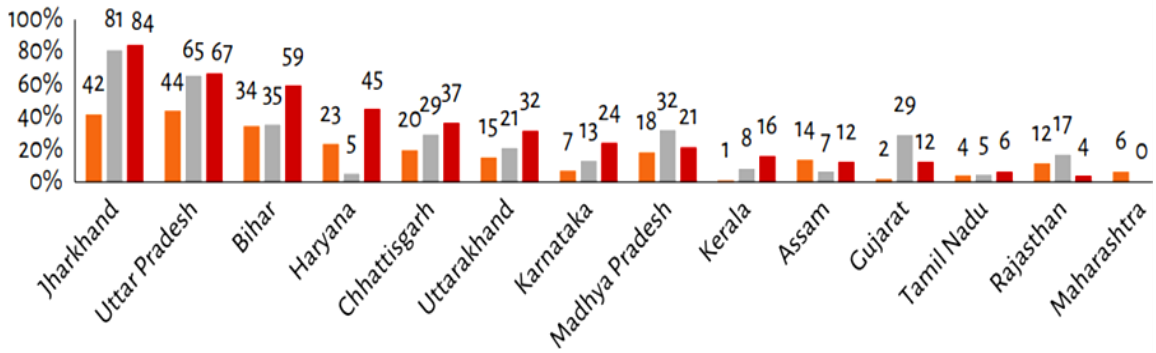

Figure 2.3 : Among large states, Jharkhand, Uttar Pradesh and Bihar had the highest rates of teacher vacancies in 2018-19

2.3 Current Scenario and ICT Based Education

The quality of ICT based education facility is very poor. The teachers get very less income so, most of the time the teachers are either absent or they do not teach properly. There are many initiatives taken by the government, but they are not implemented in the schools, so the present scenario remains the same.

Problems Faced in Rural Education in India

- Teachers of rural schools in villages and small towns receive low income so there is a possibility that teachers give less attention to children.
- There is no excess to supplemental education.

- Most of the schools do not have proper infrastructure. So they do not get most of the facilities such as computer education, sports education and extra-curricular activities.
- There are no proper transport facilities so children don't like to travel miles to come to school.

2.4 Need based ICT Education in Rural Areas

Due to various developmental activities in education department, rural schools have improving its infrastructure facilities. But the development is not uniformly in all rural areas; still many areas are neglected from even basic infrastructure facilities. Though, governments are providing

- **ICT Facilities to Rural Schools**

Many of them are not working properly. The reasons such as, lack of accessibilities of the facilities by the beneficiaries, beyond the level knowledge of users and not full fill their needs or beyond their level of needs. Thus, whenever implement the ICTs related programmes in the rural areas, should be assess local conditions and priorities needs of rural students. The assessment of needs should be following the methods of dialogue, survey and discussion with beneficiaries in rural areas.

First they have to understand the real benefits of the programme then only it will sustain in long term and perform effectively in rural areas. Existing Infrastructure in schools needs to be improved for the successful and unhindered implementation of ICT. Without proper infrastructure facilities like power, place of the centre, connectivity and computer related materials and human support the programme will not success. So before start the ICT education programme should make sure all these facilities.

- **Community Participation**

Involvement/ interest of rural students are one of the significant aspects of ICT education programme. The attitude and behaviour of rural students, accessibilities in ICTs are different from urban students. The urban areas students might have some basic knowledge in the usage of computer and its usages through their method of education and living condition, whereas the rural students may not have much awareness about the benefits of ICT to their educational improvement. So education and motivation of rural students about usages and benefits of ICT programme is an important aspect. Here, the role of teacher is vital. So, first,

clear knowledge should be provided to teachers working in rural schools on the ICTs. Majority of the rural students think computer based education is like computer training in various levels like MS word application and C, C++ programming and also one of instruments for playing games, need more English knowledge, difficult to access and getting information. So these kinds of the unnecessary taboo should be removed from their mind with help of computer graduate, who are living in rural areas and understand rural student's educational and life condition. Without knowledge about rural condition, working for development of rural education will not give sustainable success to rural ICT education programme

- **The Vision of the ICT for Education**

ICT for education should more concern about upliftment of rural community in this connection the Vision is "Integrated Development for Education and Economic Empowerment for Rural Students" The integration should be concentrate on rural life condition as well as provide information about urban areas educational developments. The ICT for education programme not only provide computer education to rural students but also it should provide information on higher education, employment opportunities in various fields. In school education, there is separate syllabus for moral class or life education it has included some vocation training class like farming, vocational training of tailoring and weaving etc. But most of the schools did not follow effectively these classes. S

o this ICT for education programme can provide these same training and awareness through computer based education technologies with effectively. Also the computer based education will disseminate information on new technological developments from local to global level. It will be a good approach to understand to the rural students about the social and technological development of world also they can easily understand to connect with their rural life condition. This kind of ICT related educational programme will provide employment opportunity to computer and other educated youths in rural as well as areas. Also it will help to rural school students to understand computer related training and wide knowledge about resent developments in world.

2.5 Need for ICT Education in Rural Schools

The Indian Education System is one of the largest in world. Planning and Management of ICT based education has primarily the matter of State but Central Government in this area. The large size and complex structures across Indian States makes the matter of policy, planning

and monitoring is highly complex. In order to improve the quality and effective ICT education, planning and management is needed in-time and in a format conforms to the requirement of the user operating agencies at various administrative hierarchies. The complexities of the multi-level decision making process and control mechanism increases due to wide geographical institutional network representing variety of school locations and endowment. Further due to the large variation in school structures, endowment and availability of teaching learning resources, the matter become more complicated.

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus. Anytime, anywhere feature of ICTs is the ability to transcend time and space.

ICTs make possible asynchronous learning or learning characterized by a time lag between the delivery of instruction and its reception by learners. Online course materials, may be accessed 24 hours a day, 7 days a week. ICT-based educational delivery (e.g., educational programming broadcast over radio or television) also dispenses with the need for all learners and the instructor to be in one physical location. Additionally, certain types of ICTs, such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners (i.e., synchronous learning).

Access to remote learning resources feature help teachers and students no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at anytime of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries, and even some in developed countries, that have limited and outdated library resources. ICTs also facilitate access to resource person's mentors, experts, researchers, professionals, business leaders, and peers all over the world

2.5.1 ICT and Teachers Training

There are many barriers and challenges in present education system, ICT is a tool which can help remove those barriers but to implement it for imparting education the teachers must

be comfortable with ICT tools and hence training teachers and continuing education in a convenient manner foe them is necessary for its proper implementation. Also there are frequent shifts in these technologies so it is necessary for teachers and students to understand these changes to impose these techniques. ICT delivers training and teaching practices as well. To enable distance learning program driven by ICT the teachers must be given an opportunity to understand the technology first and they must acquire new knowledge to be promoted. Computer training programmes must be promoted for teachers. Many countries are recognizing the use of ICT for teachers training like south Asian countries and Intel tech teacher training programmes are running across India, Pakistan and Sri Lanka, Microsoft Shiksha in India; and several other initiatives in Nepal and Bhutan are focused on using ICTs for training teachers.

Training sessions must be held at district level and for ease at least one teacher from each school must be sent for training to get certain basic knowledge about ICT and its application in school curriculum, the training lectures must be issued by teachers or trainers who are well known with implementation of ICT and its application. Visualiser can be easily operated and used by teachers which are a cost effective, easy to use and time saving tool for education in schools and colleges; it decreases teacher's preparation time, increases interactivity with students and student concentration in complex issues.

Considering the immense importance of ICTs, the government of India has formulated the National Policy on ICT enabled school education which aims at preparing youth to participate creatively in the establishment, sustenance and growth of a knowledge society leading to all round socio-economic development of the nation and global competitiveness. In India, ICTs was launched in schools in December 2004 and revised in 2010 to provide opportunities to secondary stage students for building upon their capacity on ICT skills and direct them towards computer aided learning process. ICT in schools have been included under the Rashtriya Madhyamik Shiksha Abhiyan (RMSA). The scheme is a major catalyst to bridge the digital divide amongst students of various socio-economic and other geographical barriers. The scheme also provides support to States and Union Territories to establish computer labs on sustainable basis.

2.6 ICT and Economic Development

ICT can strengthen the economy in specific sectors or in specific processes that lead to economic growth. However, ICT is simply a tool for achieving higher economic growth and

not an end in itself. Academicians, industrialists and policy makers tend to accept a direct correlation between use of ICT and positive macroeconomic growth. ICT has a vital role in connecting the rural economy to the outside world for exchange of information, a basic necessity for economic development. Effective use of ICT can demolish geographical boundaries and can bring rural communities closer to global economic systems.

In India, various ICTs have been employed over the years to promote primary and secondary education in schools. However, there have been enormous geographic and demographic disparities in their use. Some states and regions in the country currently have an enabling environment in place that allows for a greater use of ICT for education, whereas others lack such an environment. As per the 2011 census, nearly three-fourth of the Indian population lives in rural areas covering over 6 lakh villages.

The state of rural education in India is though very poor. There are very few government schools in most villages while private schools are largely concentrated in the urban areas. Children have to travel far away distances to avail basic education facilities, not to mention the acquiring of ICT skill sets and facilities. In fact, majority schools in rural areas do not provide computer education at all. The National Policy on Education provides for the scheme of ICT for all rural schools in India. Measures have also been taken to reduce and remove rural-urban disparities and promote diversified and better employment opportunities in rural areas. ASER-2014 states that for six years now ever since the turn of the century, more than 96% of children (in the age group 6- 14 years) are enrolled in school in rural India.

Approx 71% of enrolled children are attending school during the winter days. With growing and visible progress from year to year, increasing figures of enrolment and attendance in rural schools, it becomes pertinent to focus on delivering quality ICT education to this section of the population pie towards creating a learned and skilled human resource for furthering economic growth and development. The initiative of ICT Policy in School Education is inspired by the tremendous potential of ICT for enhancing outreach and improving quality of education. This policy endeavours to provide guidelines to assist the States in optimizing the use of ICT in school education within a national policy framework. The government of India has announced 2010-2020 as the decade of innovation with special focus on ICT enabled education and acquiring of ICT skills for students. The motive of the national policy on education is to create an environment of integrated development for education and economic empowerment of rural students.

2.7 ICT and Education in Rural India

India is developing as a knowledge economy and it cannot function without the support of ICT. The gap between demand and supply of education has necessitated the government and institutions to formulate policies for more beneficial use of ICT. In order to bridge the gap, it is necessary to evolve cooperation between public and private stakeholders. There is a need to focus on improving four aspects of ICT - access, usage, economic impact and social impact. The study makes the following suggestions for improving and enabling ICT education in rural India:

- The States will establish state of the art, appropriate, cost effective and adequate ICT and other enabling infrastructure in all secondary schools
- Based on the size of the school, needs of the ICT programme and time sharing possibilities, States will define an optimum ICT infrastructure in each school. Not more than two students will work at a computer access point at a given time. At least one printer, scanner, projector, digital camera, audio recorders and such other devices will be part of the infrastructure.
- Each school will be equipped with at least one computer laboratory with at least 10 networked computer access points to begin with. Each laboratory will have a maximum of 20 access points, accommodating 40 students at a time. The ratio of total number of access points to the population of the school will be regulated to ensure optimal access to all students and teachers.
- In composite schools, exclusive laboratories with appropriate hardware and software will be provided for the secondary as well as higher secondary classes.
- In addition, at least one classroom will be equipped with appropriate audio-visual facilities to support an ICT enabled teaching-learning.
- Appropriate hardware for Satellite terminals will be provided to selected schools in a progressive manner.
- Computer access points with internet connectivity will be provided at the library, teachers' common room and the school head's office to realise the proposed objectives of automated school management and professional development activities.

- ICT enabled education can be significantly enhanced and the range of classroom practices expanded with the introduction of digital devices like still and video cameras, music and audio devices, digital microscopes and telescopes etc
- Each school will be serviced with broadband connectivity capable of receiving streaming audio and video, a range of digital learning resources and interactive programmes. The number of computers given internet connectivity will be governed by the available bandwidth, in order to ensure adequate speeds.
- Teachers and students will be educated on issues related to the safe use of internet Firewalls and other security measures will be implemented to guard the school network against cyber attacks and misuse of the ICT facilities. Appropriate guidelines for network security will be developed. School heads will play an important role in establishment and optimal utilisation of ICT and ICT enabled education practices in the school. All school heads will undergo appropriate orientation in ICT and ICT enabled education training programmes. This will also help them in building up digital resources for the school.
- School heads will also be trained in processes leading to automation of administration, management and monitoring of the school system and will play a proactive role in the implementation of School Education Management Information System National and State level agencies, like the National Council of Educational Research and Training, the Central Institute of Educational Technology, the National Institute of Open Schooling, the State Councils of Educational Research and Training, the State Institutes of Educational Technology or any other public educational agency designated by the State will develop curriculum, resources, and undertake capacity building programmes, which will serve as models for adaptation and implementation across the system. These activities will not be outsourced.
- The States' Department of Education will spearhead an advisory group to guide the implementation of the ICT programme, its monitoring and evaluation. The advisory group will consist of the concerned Departments, a reputed engineering Institute of the State, University Departments, etc taking into consideration the variety of technical, educational, financial and administrative tasks involved. The States' Department of Education will synergise with the appropriate departments and state level agencies to

ensure the establishment of connectivity and electricity in all schools. This will include negotiated norms for pricing, quality of service and maintenance.

Using computers and the Internet as mere information delivery devices grossly underutilizes its power and capabilities. There is an urgent need to develop and deploy a large variety of applications, software tools, media and interactive devices in order to promote creative, aesthetic and analytical and problem solving abilities and sensitivities in students and teachers. Use of ICT will catalyse the cause and achieve the goals of inclusive education in schools. ICT software and tools to facilitate access to persons with disabilities, like screen readers, Braille printers, etc. will be part of the ICT infrastructure in all schools. Special care will be taken to ensure appropriate ICT access to students and teachers with special needs. All teachers will be sensitised to issues related to students with special needs and the potential of ICT to address them.

All capacity building programmes will include components of ICT enabled inclusive education. Teacher participation in the digital content development process will catalyse its broad based usage in the classrooms. Teacher capacities will be developed in instructional design, selection and critical evaluation of digital content and strategies for effective use of digital content to enhance student learning. National Council for Teacher Education (NCTE) has already laid down guidelines about availability of ICT infrastructure in each such training institution. NCTE would prescribe appropriate curriculum in ICT corresponding to the ICT curriculum in schools, to be revised periodically for such teachers. School clusters encompassing neighbourhood schools will be established for sharing and learning from each other aiming to hasten the process of integration of ICT into all aspects of the school system.

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CHAPTER - 3

Rural Empowerment and Development Strategies in India

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3.1 Introduction

Until the 1970s, rural development was synonymous with agricultural development and hence focused on increasing agricultural production. This focus seems to have been driven primarily by the interest of industrialization to extract surpluses from the agriculture sector to reinforce industrialization. When acquiring an understanding of rural development approaches and strategies, it is essential to acquire an efficient understanding of areas in rural communities, which are in a backward and underdeveloped state and which need to be improved. When the individuals are involved in the implementation of strategies and approaches, then they need to be aware of major objectives of rural individuals.

In rural communities, there are number of aspects that need to be developed. These include, education, employment opportunities, agriculture and farming practices, administration and management, infrastructure, civic amenities, health care and medical and environmental conditions. When improvements would take place in these areas, then rural individuals would be able to secure better livelihoods opportunities. Furthermore, when approaches and strategies are formulated by the Government, organizations and other agencies, then it is vital to generate awareness among rural individuals and help them in acquiring benefits of these measures and approaches in an appropriate manner.

The establishment of the Millennium Development Goals has significantly reinforced the concerns about non-income poverty. With the parading shifts in economic development from “growth” to broadly defined “development”, the concept of rural development has begun to be used in a broader sense. In more recent years increased concerns on the environmental’ aspects of economic growth have also influenced the changes. Today’s concept of rural development is fundamentally different from that used about three or four decades ago. The concept now encompasses “concerns that go well beyond improvements in growth, income and output. The concern include an assessment of changes in the quality

of life, broadly defined to include improvement in health and nutrition, education, environmentally safe living conditions and reduction in gender and Income inequalities.

Today, there seems to be a universal consensus that the ultimate objective of rural development is to improve the quality of life of rural people. This makes it essential to go beyond the income-related factors such as prices, production, and productivity to a range of non-income factors that influence quality of life and hence inclusiveness of rural development. Inclusive rural development is more specific concept than the concept of rural development. In broader terms, inclusive rural development is about improving the quality of life of all members of rural society. More specifically, inclusive rural development covers three different but interrelated dimensions.

1) Economic dimension
2) Social dimension
3) Political dimension

Economic dimension encompasses providing both capacity and opportunities for the poor and low-income households in particular III benefit from the economic growth. Social dimension supports social development of poor and low- Income households, promotes gender equality and women's empowerment and provides social safety nets for vulnerable groups. Political dimension improves the opportunities for the poor and low Income people in rural areas to effectively and equally participate III the political processes at the village level. The notion of rural development has been conceived in diverse ways by researchers, ranging from thinking of it as a set of goals and programmes to a well-knit strategy, approach or even an ideology. There is a widely shared view that its essence should be poverty alleviation and distributive Justice oriented economic transformation.

3.2 Components of Rural Development Policy

The policies that are formulated to bring about rural development are required to incorporate the components, which have been stated as follows -

❖ *Environmental Conditions*

The first component is the individual and his environment. The individuals need to develop the skills and abilities to make effective use of resources that the natural environmental conditions are providing. On the other hand, the individuals are required to generate awareness in terms of various strategies and approaches that are required for the preservation of the environment. Curbing various forms of pollution is regarded to be of

utmost significance. The rural individuals need to be aware of various strategies and methods for keeping the water bodies and environmental conditions clean. Furthermore, they should be aware of making effective use of resources to improve the living conditions.

❖ *Ecological Settings*

The second component focuses upon ecological setting. Ecological setting refers to the principle biophysical characteristics at multiple scales that have a strong influence upon the composition, structure, and function of the particular ecosystem, over a long period of time and serve to describe and distinguish it ecologically. The major aspects that need to be taken into account in the case of ecological settings are, wetness, soil depth, temperature, solar exposure and wind exposure that define the ecological characteristics (Conservation Assessment and Prioritization System, n.d.). It is vital for the rural individuals to possess adequate information, in terms of these traits, particularly when they are engaged in agriculture and farming practices.

❖ *Technology*

The third component of rural development is making use of technology. The rural individuals have recognized the significance of technology. They are aware that making use of technical methods would make their tasks and activities manageable. In the present existence, they are making use of technical methods in the agriculture sector, farming practices and production and manufacturing of goods. In addition to the use of technology in the implementation of tasks and activities, individuals are also making use of it, in the form of mobile phones and computers to augment their knowledge and information. The elderly individuals and home-makers usually make use of it for leisure and recreational purposes.

❖ *Infrastructure*

The development of infrastructure is integral to the development of rural areas. The infrastructural facilities that need to be developed in rural communities are, roads, transportation, communications, power supplies, water supplies, public services, broadcasting and telecommunications. In rural households, individuals experience shortage of power supplies and water supplies. They are required to fetch water from the wells or water bodies, located nearby. The conditions of roads and modes of transportation are not in a well-developed state, which are imposing problems for the individuals in transferring from one place to another. Therefore, developments made in the infrastructural facilities are integral to rural development.

❖ *Self-Reliance*

When focusing upon rural development, the development of individuals is regarded to be of utmost significance. The rural individuals are mostly illiterate and unaware. They are residing in the conditions of poverty and backwardness and possess traditional viewpoints and perspectives. Their lives are primarily based upon their perspectives and viewpoints. In order to promote their well-being, it is necessary to promote self-reliance among individuals. This can be brought about through mobilization of resources, local initiatives and participation of the individuals in various tasks and activities, which may be social, political, cultural, economic and religious

❖ *Law and Order*

In rural communities, the establishment of law and order enables the individuals to organize tasks and activities in accordance to the rules and policies. Law and order is referred to the maintenance of peace and tranquillity, which the citizens are required to put into operation for obeying the law of land. For instance, there has been prevalence of discriminatory treatment and criminal and violent acts within rural communities. Through the implementation of law and order, the individuals, who are doers, get subjected to disciplinary action.

Therefore, the main objective of law and order is to ensure the individuals make provision of equal rights and opportunities to both males and females. Furthermore, there should not be any kind of discrimination on the basis of any factors, including, caste, creed, race, religion, ethnicity, gender and socio-economic background. The individuals should inculcate the traits of morality and ethics among themselves, for leading to progression of themselves as well as the community as a whole.

❖ *Education*

The education is regarded as the main instrument that lays the foundation for the individuals to lead to progress in all areas and enrich their overall quality of lives. In rural communities, the system of education is not in a well-developed state. In schools, the teaching-learning methods and instructional strategies are not put into practice in an effective manner, there is lack of infrastructure, facilities and amenities and shortage of qualified and experienced teachers. Measures need to be formulated to bring about improvements in these aspects, so there would be an increase in the enrolment of students in schools. Acquisition of education would enable the individuals to augment their skills and abilities, so they can carry out tasks and activities to sustain their living conditions in an appropriate manner.

❖ ***Training Programs***

The development of training programs among rural communities is essential for the progression and well-being of the individuals as well as to enable them to augment productivity and profitability. Agriculture is regarded as the major occupation of the individuals in rural areas. In order to enhance productivity, it is vital for the individuals to get enrolled in training programs and acquire knowledge in terms of modern and innovative methods and strategies. There have been establishment of training centres, which are providing knowledge and rendering an effective contribution in the up-gradation of skills of the individuals. The different areas include, health care, diet and nutrition, child development, handicrafts and artworks, and so forth.

❖ ***Distributive Justice***

The distributive justice involves operationalization of the value of access entails exercises of power and authority. It follows both the matter of common sense and empirical observation. The creation, structuring, reinforcement and boundaries of access opportunities will be related to the main features of distribution of management and power within society. To the extent, power needs conversion into authority, the value of access by itself will not be ignored. On the other hand, considerations of power, in the here and now sense will not be sacrificed in the pursuance of the desired goals and objectives. The legal systems make provision of access institutions, rather than dispute institutions.

❖ ***Medical and Health Care***

The establishments of health care centres are regarded to be of utmost significance, as individuals, belonging to all age groups and backgrounds are required to take care of their health care needs and requirements. When the individuals are in good health, then they would be able to effectively get involved in the implementation of various tasks and activities. These include, management of household responsibilities, child development, agricultural and allied activities, taking care of needs and requirements of elderly family members, participation in social, political, religious, economic and cultural programs and carrying out daily routine activities. In old age, individuals are required to pay adequate attention towards one's health care and obtain regular medical check-ups.

3.3 Strategies in Rural Development

A strategy consists of an ordering of various policy parameters to attain the desired goals. Different strategies emphasize and give importance to different mixes of agrarian relations,

techniques of production and state policies in order to achieve the goals of rural development. Followings are various types of rural development strategies giving central importance to agrarian relations for purpose of classification

1) A strategy based on collectivization of resources
2) A strategy based on regulated capitalist perspective
3) A strategy based on peasant agrarian perspective
4) A strategy based on Laissez-Faire or un-regulated free market capitalist perspective

These strategies do not constitute an exhaustive list and are simply illustrative.

❖ Strategy based on Collectivization of Resources

Collectivization of rural assets (particularly land) is given almost importance in the first strategy. Private ownership of land is abolished so that not only inequalities in the ownership of land are eliminated but also land use can be made more productive. The latter is achieved because small plots of land can be consolidated so that large scale cultivation also raises productivity by creating possibilities for the use of modem technology in the shape of tractors, harvesters etc. This strategy with fairly good success was followed in the Soviet Union, China and the East-European countries. These countries were able to make sharp Increases in production soon after they initiated this strategy. However, for a variety of reasons which are too complex to be recalled here, the erstwhile socialist regimes have collapsed or changed course dramatically and this strategy is not in operation anywhere currently.

❖ Strategy based on Regulated Capitalist Perspective

This strategy envisions a co-existence of a capitalist sector and a peasant sector that gets same support and protection from the state. Any Large-scale redistribution of land or reconfiguration of land relations are ruled out. It is hoped that the objective of rapid growth would be taken care of by the capitalist sector while the peasant sector would address the problem of unemployment till the time the non-agricultural sectors start growing at a rapid pace. It has been pointed out that without meaningful land reforms, strategy can only have limited success, rural inequalities are ignored in this strategy.

Rural elites on the one hand exercise control and prevent changes that will bring about a change in the unequal distribution of assets (land) and on the other comer a large part of whatever resources are pumped in from “outside” to better the lives of the poor. An example of this is provided by the way banking co-operatives have operated in India. A great

portion of rural credit disbursed through co-operative Institutions has gone into the hands of those who are better off and have the capacity to mobilize their own resources. Thus, it is pointed out that this strategy avoids taking hard decisions to make a break-through in rural development that can create conditions for the rapid development in rural areas.

❖ Strategy based on Peasant Agrarian Perspective

The strategy based on the peasant agrarian perspective argues for thorough going redistribution of land and overhaul of land relations. It envisages strong support for small peasant units, which are supposed to take care of the twin-objectives of growth and employment. An extensive network of co-operative Institutions, marketing facilities etc. is accorded critical importance in this strategy. Both in the second and the third strategies, it is envisaged that the state will play important roles in promoting and strengthening the non-agricultural economic activities in the rural areas, so as to ease the pressure of surplus labour on agriculture and to facilitate the creation of decent livelihood options elsewhere in the long run. It is expected to perform a whole range of important functions. Furthermore, it is assumed that the problem of adequate infra structure in rural areas will be addressed by the state and also the investments in social sectors such as education, health etc.

❖ Strategy based on Unregulated Capitalist Perspective

Such a strategy presumes that rich landowners will play the vanguard role in rapid increase in agricultural output, by taking advantage of the economies of scale and gradually the small cultivation units will disappear. It is suggested that the state should not intervene in the expansion of the capitalist sector and there should be no ceiling on ownership. Unfettered expansion of this sector is supposed to provide a dynamism that will over, all rural economy and the benefits from it, through employment and increasing incomes, are supposed to percolate even to the lowest strata. The Issues of inequality and distributive Justice are considered non-issues in such a strategy, to the extent the state has a role, it is with respect to infrastructure, but there too it is not viewed as the major actor necessarily. The core concerns of a rural development strategy may be listed here as follows:

1) Agricultural research, extension rural education and training programmes for farmers form a part of institution building activities.
2) Infrastructure building activity related to the growth of irrigation, transport, communications and health facilities.
3) Programmes to improve marketing facilities for the distribution of agricultural inputs and implements.

4) Policies related to land tenure, agricultural output, prices and taxation of agricultural incomes.

3.4 Models of Rural Developments Strategies

Based on the experience of market economies as regards to Hip approach towards distribution of land, types of strategies for fostering the growth of the agricultural sector can also be classified as “uni-modal” and “bi-modal” strategies.

3.4.1 Uni-modal strategy

A uni-modal strategy is one in which land holdings arc equitably distributed. This strategy was followed with tremendous success in the case of Japan, Taiwan and Korea. It seeks to promote rural development through the use of thorough going reforms in the agricultural sector. Thus, because of the land reforms and the consequent even distribution of rural assets, resources meant for the agricultural sector are also spread evenly. This type of agricultural strategy creates a situation that enables rapid growth of agricultural production with equitable distribution of incomes. This in turn not only results in rapid rural development but also provides an important basis for overall economic development.

3.4.2 The bi-modal strategy

The bi-modal strategy for the growth of the agricultural sector attempts to increase agricultural production without making attempts to drastically change the skewed distribution of incomes and assets in rural areas. Many countries in Latin America are examples of this type of strategy. In this type of strategy, there is no attempt to bring about land reforms. A large number of small farms co-exist with a small number of large size holdings. The idea is to concentrate modern technology and inputs to the latter and thereby achieve agricultural growth. Such a growth pattern clearly ignores a whole range of developmental concerns and is also unable to provide strong foundation for overall economic development

3.5 Model of Development

Globalization has made life easy for migrant capital (foreign investments like FDI, FII, etc.) not for migrant labour. This can be reflected in the recent migrant crisis that emanated from Covid-19 pandemic. Also, the pull factor for migration i.e employment opportunities has been severely affected due to such pandemic. Therefore, the need is to attain self-reliance, especially in rural areas. Rural areas are the main source of providing migrant labourers. In

this context, India can take some lessons from Lee Kuan Yew, the founding father of modern Singapore and from Mahatma Gandhi, the father of the Indian nation.

3.5.1 Singapore Model of Development

- Lee Kuan Yew is known as the founder of modern Singapore, which was founded in 1965.
- Under three decades of his leadership (1965 to 1990), the former British colony of Singapore got transformed from a poor fishing hamlet into a global financial hub and economic powerhouse.
- A key plank of Lee's model from the beginning was to **attract foreign investment by assuring investors world-class infrastructure, an efficient administration, and low taxes**.
- In return, he did not want multinational companies to merely set up labour-intensive assembly factories, rather he wanted the companies to train Singaporeans to do higher-value work.

According to Lee, humans are not tools to produce returns for investors; rather, money is a tool to produce benefits for humans. Thereby, people of Singapore would earn more and the country would become fully 'developed'. The ultimate measure of Singapore becoming fully developed was not the size of its GDP, but the incomes of its citizens. In order to address the roadblocks (crony capitalism, corruption, political interference etc) to an efficient market economy, he established mechanisms to ensure honest and accountable governance.

3.5.2 Gandhian Economics

Issues related to rural areas in India are more complex than Singapore. The Gandhian vision of Poorna Swaraj becomes important in this context. According to the Gandhian idea of Poorna Swaraj, in order to become fully independent, people in India's villages need to have economic and social freedom. Gandhi believed that the economy must serve human needs, rather than human beings becoming fodder for the GDP. The major principles of Gandhian economics that can be applied in the Indian economy:

- **Enabling Gram Swaraj:** According to Gandhi, the progress of human beings and local communities must be the means for economic growth. Further, the governments must be strengthened at the local level, in villages and cities.

- **Concept of Trusteeship:** The concept of trusteeship as enunciated by Gandhi, demands non-possession. It seeks individuals to dispossess their wealth and income beyond their requirements so that the economic welfare of the less capable is realized. According to him, wealth is good, but wealthy people must be only trustees of a community's wealth and not its owners.
- **Formation of Co-operatives:** The alienation of owners from workers must be reduced with the creation of new models of cooperative capitalist enterprises, where the workers, not remote capitalists, or the state, are owners of the enterprises.
- **Focus of Sarvodaya:** The government must focus on the well-being of the poorest and weakest member of society.

The health crisis and the economic crisis emanating from Covid-19 have prompted governments at all levels, whether international, national or state, to strive for self-reliance. India, under recently launched, Atma Nirbhar Abhiyan envisages self-reliance. This can be achieved by the confluence of ideas of Mahatma Gandhi and Lee Kuan Yew. Following factors become significant in this context -

- **Syncing Skills with Business:** The government must encourage private investors to play a critical role in skill up-gradation and subsequent employment of India's Youth. Giving tax incentives for those firms who help in skill up-gradation may be a step in the right direction. This will not only help in making the trickle-down effect possible but also leverage India's demographic dividend.
- **Democratic Decentralization:** There is a strong need for providing functional autonomy to grassroots democracy at Panchayati raj institutions and urban local government.
- **Ensuring Accountability:** The government should initiate reforms under Part XIVth **(Services Under the Union and the States)** of the Indian Constitution which makes it difficult to dismiss corrupt officials. Also, governance policy must be committed to implementing systems that continuously attract the best talent to politics and governance.

One thing of course, that India can reject from the teachings of Lee Kuan Yew is the limits to freedom of expression and its limited democracy that depended critically on having one good person at the helm. Also, Gandhi's averseness to technology which very much defines the past, present and future, is much debated today.

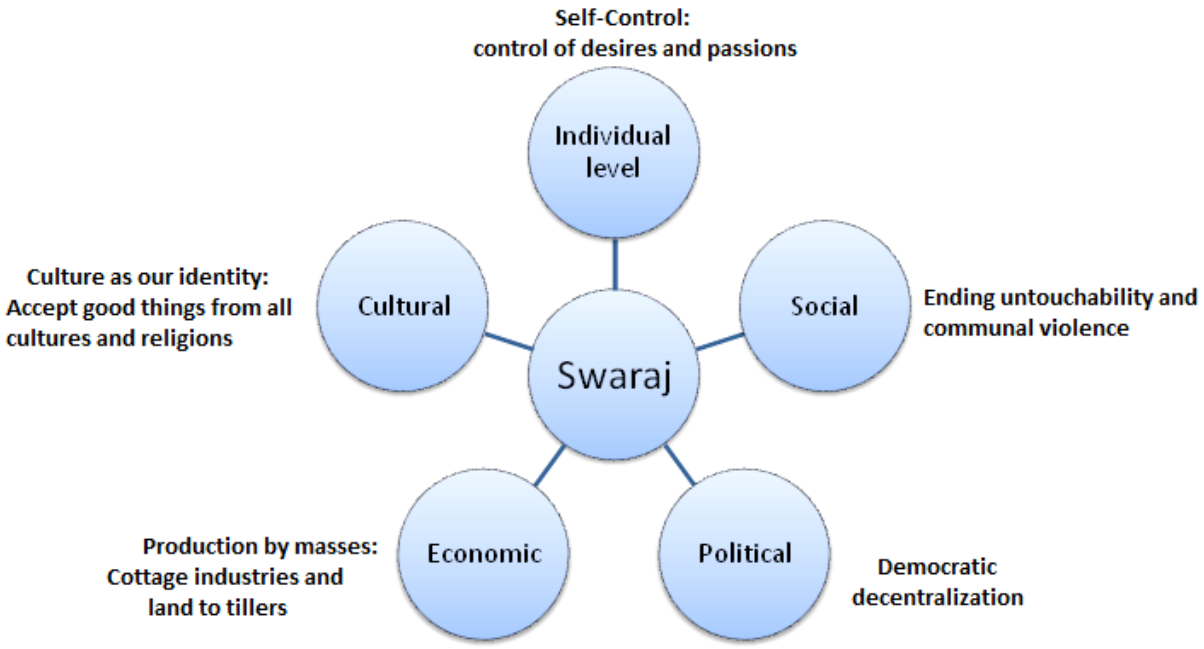

Figure 3.1 : Gadhian concept of Swaraj

In present time, earlier development models seem missing in policy formulation process. The reason may be their irrelevance. However, no alternative models are being discussed or proposed. Temporary and sporadic plans have taken the space of development models. But challenges emerging out of an ongoing economic process which is changing employment structure, creating unproductive works and changing the settlements classification, can't be dealt with such short-sighted plans. In rural India, a large number of working population are shifting from farm to unproductive and low wage non-farm employment. The consequences are not restricted to only rural employment structure, but it is also causing classification of rural areas as unban units which is termed as census towns by Census of India. The future of pattern of both employment and urbanis0ation would depend on how governments deal with this on-going process.

In rural India, majority of workers are getting absorbed in low wage and unproductive non-farm works as agriculture is not a sustainable livelihood option for majority of rural working population. Most of them are daily wage workers, transporters, petty shop owners, construction workers etc. In rural India, around half of workers are self-employed. The main problem is high share of casual labour. In rural India, around one-fourth of working population are casual labour. Rural India's employment problems should not be viewed from

the perspective of merely unemployment and nature of works. But, the mechanism by which these rural workers should be absorbed in non-farm employment must be the prime concern of the government. This is crucial as the changing employment pattern is also transforming rural areas into urban areas. In 2011 Census, a large number of rural areas were classified as census towns. Out of 2774 new towns reported by 2011 Census, 2532 were census towns.

The main criteria, among others, are high share of male main workers (75% or more) in non-farm sector. This implies that India is getting new urban centres with rural characteristics. The planning to administer these urban centres is lacking at the state level. Productive employment generation on mass scale seems to be a distant dream in the absence of robust manufacturing sector. W. Arthur Lewis argued in favour of manufacturing activities to absorb rural labour surplus. In 1950s and 1960s, heavy industrialisation was started to accelerate the economic growth. It had successfully absorbed a substantial number of rural labour. But this phenomenon was restricted to certain regions. The possibility of second phase of heavy industrialisation to absorb labour is negligible. Although, building robust manufacturing sector has always been one of the main promises that political parties make in their manifesto.

Challenges to building a robust manufacturing sector are big and arduous. But household and small manufacturing units can be crucial in absorbing rural labour and providing productive employment. In many small urban centres, which are near to rural settlements, substantial shares of working population are engaged in household manufacturing units. In Uttar Pradesh, substantially high percentage of workers, above 20%, are engaged in household manufacturing units in 38 census towns. The share is above 60% in some of these census towns. These manufacturing units require financial and technological support. Government's assistance to household and small manufacturing units must be done in mission mode in small urban centres situated near rural settlements. It may work as an alternative to heavy industrialisation suggested by W. Arthur Lewis to absorb surplus rural labour.

Certainly, government's financial and technological support will enhance the productivity of these manufacturing units. Undoubtedly, India's development path and urbanization pattern will be determined by the dynamics of occupational changes in rural India. Moreover, an ongoing occupational change in rural India is widening the gender gap in work and wages. In rural India, it is difficult for female workers to get absorbed in non-farm employment. But household and small manufacturing units can provide productive employment to rural female workers. Development programme with specific emphasis on productive non-farm

employment generation is essential in and around rural settlements to deal with challenges arising out of occupational changes in rural India, mainly shift of working population from farm to non-farm employment.

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CHAPTER - 4

Role of Information & Communication Technology (ICT) in Uplifting the Livelihoods of Rural India

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4.1 Introduction

According to the definition of UNESCO, ICT can be defined as diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices) and telephony (fixed or mobile, satellite, vision/video-conferencing, etc.)

ICT is the innovative tool for rural upliftment. Information and Communication Technology can be deployed effectively for the betterment at grass root levels. On the other hand so many constraints are associated at implementation stage to attract rural masses where as it is difficult to grab attention of illiterate population, to motivate them for adoption of the new technology.

4.2 Scope and Importance of ICT

Recent trends in Information and Communication Technology (ICT) have introduced a paradigm shift of development in every arena. ICT has crossed all limits of price, distance and time. The perfect blend of computing and communications specifically through internet has minimised the gap worldwide and converted to global village by strengthening easy assessment. The major factor responsible for development in rural areas is proper communication. Traditionally it includes print and electronic media, human communication and recently information technology (IT). ICT plays a pivotal role in bridging the gap in

community in general and rural area specifically. Proper dissemination of information is desired to avail various opportunities and get benefit out of that. Timely and accurate availability of information can strengthen rural areas and it can add these areas in mainstream of development. Improper knowledge about each and every sphere of rural India can be addressed and the backbone of remote areas can be strengthened

4.3 ICT in Agriculture

ICT in Agriculture focus on the enhancement of agricultural and rural development through improved information and communication processes. Information and Communication Technology is consisting of Devices, Networks, Mobiles, Smartphones, different application & Services. Agriculture is an important sector with the majority of peoples from rural areas in various countries (mostly in developing countries) depends on Agriculture for their livelihoods. In recent times due to various erratic climatic conditions, the agriculture sector faces major challenges in enhancing the production. ICT plays a crucial role in addressing these challenges and uplifting the living standards & Socio-economic status of rural people. ICT in Agriculture and allied sectors offers a diverse range of solutions to the newly emerging issues & challenges in farm management practices. It is seen as emerging field focusing on the enhancement of growth on agricultural and rural development through improved techniques & Processes.

4.4 Role of ICT in Agriculture and Allied Sector

ICT plays a vital role in Agriculture extension & Advisory services and it bridges the gap between the agricultural students, Researchers & academicians. It also supports and promotes the eco-friendly and Sustainable farming practices. ICT also plays a vital role in climate smart agriculture, Disaster Management & Providing real time early warning systems. It also provides actionable and important information to the farming communities and other communities for disaster preventions and other natural hazards.

ICT enabled device also facilitate the market access and provide the market information of various market yards. ICT also plays a vital role in food security and traceability. By using the ICT enabled device rural communities get the access for financial services, secure savings procedure and getting affordable insurance policy. It also plays a greater role in capacity building and improvement of rural communities and helps them to provide training, newer business, entrepreneurial opportunities and enhancing their livelihoods.

Information and Communication Technology also assists with implementing regulatory and policy frameworks. ICT also helps to increasing the efficiency, productivity & sustainability of the small scale farms; provide information about pest and disease control, new varieties, early warning systems, regulations in quality controls. It also provides up to date market information on prices of various good and commodities

4.5 Role of ICT in Rural Development

ICT encouraging the Social transformations by facilitating the flow of information and knowledge, it intensify efforts towards implementation of rural development initiatives through demand-driven information & Communication services, it also helps in strengthening the rural governance by improving transparency, accountability and administrative efficiencies of rural institutions. Various application of ICT also plays a vital role to improve the living standards of rural people. ICT tools emerged as a key element for economic growth and development. It is also helpful in digitalizing the Indian Economy, which can help the sustainable development of the rural economy of India by increasing the Production, Productivity & impacting operation & expansion of markets.

4.6 ICT in Rural Education

Application of ICT has the potential to improve the living standards of people in rural areas and by providing important educational benefits, providing adequate infrastructure, technical support, to promote technology literacy. ICT also plays an important role in Provide necessary training facilities to rural people. By using the ICT technologies, people living in rural areas getting information and awareness about various schemes. Although ICT plays an important role in rural education but there is so many challenges including illiteracy, poverty, lack of knowledge for government Schemes, lack of suitable telecommunications, lack of computer knowledge's & awareness.

4.7 ICT initiatives in Agriculture

Different agencies like Government Sector, NGOs. Private Sectors are always focusing on enhancing the agricultural Productivity, which also plays vital role in uplifting of livelihoods in rural areas. Different ICT enabled device and smartphone apps also helps farmer for agricultural information dissemination & agro-advisory services. Different examples are given below-

- **E-Sagu**

e-Sagu provides the agricultural scientists and expert advice in a timely manner. The experts can observe the farm situations by means of digital photography and after analysing the issues the information is delivered to the concerned farmer.

- **Digital Green**

This is a global development organisation that empowers small holder farmers to lift themselves out of poverty by harnessing the collective power of technology. It is an independent Non-governmental organization that focuses on training farmers to make and show short videos, where they record their problems, share solutions & highlight the success stories. Digital green works across seven states India, part of Ethiopia, Ghana &Afghanistan.

4.8 Role of ICT in Capacity building and Empowerment of Rural Women

Women play a vital role in diversified fields sectors as economic, agriculture, political, social, sports, educational, enterprising etc. Women are very crucial part of Indian economy. The new era of women empowerment started with the concept of Self Help Groups, which is now catching the attention of policy makers. IT enabled services are acting as a helping hand for rural women to gather more productive information and to utilize in various dimensions of our services.

E-Commerce is the trend of new generation which can be effectively utilised by women. All the ICT tools can be helpful for gender sensitisation so that the untouched segments can be effectively performing their duties. There is potential for ICTs to eliminate gender inequality and to empower women in society. There is growing body of evidence on the benefits of ICT for women's empowerment, through increasing their access to health, nutrition, education and other human development opportunities, such as political participation.

4.9 Schemes for Women Empowerment

Several schemes have been launched for mainstreaming gender issues and sensitising women in several aspects. ICT deployed in the field of women empowerment effectively.

- **Mahila E-haat**

It was launched in 7th March 2016; it was a direct marketing platform where women entrepreneurs are connected in that online platform for trading aspects. SHGs and NGOs are

included in this scheme. This platform was promoted by the Ministry of Women and Child Development. This is also part of the 'Digital India' initiative.

❖ One Stop Centre Scheme

This scheme is well known as 'Sakhi'. It was implemented on April 1, 2015. One-Stop Centres are located at various places nationwide to provide shelter, police desk, legal, medical and counselling services to victims of violence under one roof, it is an umbrella approach.

❖ STEP

The Support to Training and Employment Programme for Women (STEP) implemented to impart skills that can provide employment opportunities to women and to educate them so that they can be self-sufficient and can became sufficient women entrepreneurs. Under this scheme diversified activities are undertaken in this programme. It includes Agriculture, Horticulture, Food Processing, Handlooms, Tailoring, Stitching, Embroidery, Zarietc, Handicrafts and Computer & IT-enabled services. It also imparts training for skill enhancement.

❖ SGSY

Swarnajayanti Gram Swarojgar Yojana (SGSY) was implemented from 1-APR-1999.It was an umbrella scheme which consists of integration of Integrated Rural Development Programme (IRDP) ,Training of Rural Youth for Self Employment (TRYSEM),Development of Women & Children in Rural Areas (DWCRA),Supply of Improved Toolkits to Rural Artisans (SITRA),Ganga Kalyan Yojana (GKY), Million Wells Scheme (MWS). It is a holistic scheme which emphasises on poverty alleviation, capacity building of SHGs, helping the physically challenged and BLP holders by providing loan on subsidised basis. Major objectives of SGSY is to promote techno-economic support to landless labour, unemployed youths, rural artisans

❖ Ujjawala

It involves local communities to prevent trafficking of women and children; it provides protection to the deprived segments for women in remote as well as in urban areas. Various awareness programmes are being conducted for sensitising rural women and children. Apart from trafficking prevention it also act as rehabilitation centre for victims and provide all basic amenities for upgrading their mental and physical health. Vocational training programmes are conducted for capacity development of women.

❖ **Nirbhaya**

This scheme is implemented by Ministry of Women and Child Development; it ensures safety and privacy of women. This scheme encourages women to walk freely and safely in roads by helping them and safeguarding form any mishappenings. Several technologies are integrated and deployed for tracking purpose and reduces crime against women.

4.10 Importance of ICT for Rural Upliftment

India being dominated by villages it requires optimum attention for all round socio-economic development of villages to witness a major development nationwide. It can be successfully achieved effectively utilising the powerful tool i.e. ICT, which can act as a helping hand by adding betterment in diversified fields of rural areas as follows.

- It can strengthen Agricultural production and productivity as farming in the dominant occupation in rural India. ICT enabled tools can serve enhancing the profit.
- Basic infrastructure facilities can be developed
- Social issues related to health, education, hygiene, sanitation can be addressed.
- Benefits of various government sponsored schemes can be availed
- Capacity building programmes can be fostered, rural youths and women can get immense benefit out of ICT.

4.11 Challenges faced in Application of ICT for Rural Development

Though ICT is having immense potential for bridging the gap worldwide and to transform to a global village till then it is also associated with several challenges which hampers in penetration of this process in rural areas.

- Lack of awareness among rural people related to various applications and benefits of ICT.
- Education plays a vital role in effective dissemination of ICT, which is a major loophole in rural areas, so ICT should be supported by proper education.
- Lack of connectivity and internet unavailability is a major hindrance related penetration of ICT in rural areas.
- Cyber-crime is an emerging bottleneck in the field of ICT which requires thorough attention.
- Lack of experts in rural areas as they prefer to work in urban areas, so lack of proper guidance is also a major challenge for application of ICT in rural areas.

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CHAPTER - 5

Attitude of Postgraduate Students towards ICT in Rural Area

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5.1 Introduction

Inventions and fast development in technology has made a great impact in the field of education. The technology used by education ranges from some simple methods like general teaching in classroom to highly developed teaching such as virtual classroom and teleconferencing. Informational Communication Technology decorates an educational system and this is an age of knowledge explosion where traditional methods of verbal instruction will not help to keep pace with the development of knowledge. We are on the threshold of a new information era, which is the mantra of today. Internet is the flower gifted by information technology (IT). It is the latest buzzword among the computer users and users of the information centers nowadays. Everyone whether anyone is working in the field of IT or not, is eager to know about Internet and its use.

Internet is advancing so rapidly that it is affecting the life of everyone. It can be said that we are living in the age of Internet. It has made an increasing and powerful impact upon almost every working place like *home, school, college, office, industry, business, science, education, hospital, bank, railway, airway, airline traffic, research design, organization, society* and so on. Almost all occupations and academic disciplines have been profoundly influenced by the use of Internet.

5.2 Concept of Internet

The Internet is a network of networks, linking computers to computers sharing the TCP/IP protocols. Each runs software to provide or 'serve' information and/or to access and view

information. The Internet is the transport vehicle for the information stored in files or documents on another computer. It can be compared to an international communications utility servicing computers. The Internet itself does not contain information. It is a slight misstatement to say a "document was found on the Internet." It would be more correct to say it was found through or using the Internet.

5.3 Internet in Education

Internet is an exciting innovation in the field of education. The following are the areas where the Internet is being used effectively.

a. Internet allocates learning resources to individuals and groups;
b. Internet helps the students to collect related information from outside world;
c. The students can give the educational information with the help of e-mail on computer;
d. Internet provides direct interaction between students and the subject matter to be learned;
e. Internet engages the students in tutorial interaction and dialogue;
f. Internet provides easy access to files of information for reference and guidance;
g. Internet can be used as supplement to traditional instructional methods;
h. Internet can be used to replace the traditional classroom situation.

In this way, it also serves as an encyclopedia since one can get the desired information in detail on any subject of his interest. In order to find out what the students feel, what they think and what attitude they have with regard to the Internet, the present study was undertaken.

5.3.1 Objectives of the Study

- To study the attitude of the postgraduate students towards the Internet.
- To compare the attitude of male and female postgraduate students towards the Internet.
- To compare the attitude of rural and urban postgraduate students towards the Internet.
- To compare the attitude of arts and science postgraduate students towards the Internet.
- To compare the attitude of science and commerce postgraduate students towards the Internet.

- To compare the attitude of arts and commerce postgraduate students towards the Internet.

5.4 Hypotheses of the Study

Keeping in view the objectives of the study, the following hypotheses were formulated for the present study.

- The postgraduate students have a favorable attitude towards the Internet.
- There exists significant difference in the attitude of male and female postgraduate students towards the Internet.
- There exists significant difference in the attitude of postgraduate students belonging to rural and science streams.
- There exists significant difference in the attitude of postgraduate students belonging to arts and science streams.
- There exists significant difference in the attitude of postgraduate students belonging to science and commerce streams.
- There exists significant difference in the attitude of postgraduate students belonging to arts and commerce streams.

5.5 Research Methodology

In order to achieve the objectives of the present investigation, survey method was undertaken. The methodological details like sample, tool, and procedure of data collection, scoring procedure and statistical techniques are given below:

Sample

The sample of present study consists of 200 postgraduate students of Ram Manohar Lohia University, Ayodhya(Faizabad) and was drawn through random sampling technique. The details of sample distribution are given in table 5.1:

Table-5.1 : Distribution of Sample

Stream			Sex		Locality	
Arts	Science	Commerce	Male	Female	Rural	Urban
102	64	34	132	68	114	86

❖ Tool Used

In order to achieve the objectives of the study, the investigators used a self-prepared questionnaire.

❖ Data Collection

In order to assess the attitude of the postgraduate students towards the Internet the questionnaires were distributed to them and were collected back after half an hour. The reason for taking questionnaire back within half an hour was that they should not get a chance to interact with others and be influenced in their responses.

❖ Scoring Procedure

There were 40 items in the questionnaire. Out of 40 items, items 1 to 26 are positive statements and items from 27 to 40 are negative statements. For each positive statement, five alternatives of answers were given on the right side. These were 'Strongly Agree', 'Agree', 'Undecided', 'Disagree' and 'Strongly Disagree'; the scores were 5 for Strongly Agree, 4 for Agree, 3 for Undecided, 2 for Disagree and 1 for Strongly Disagree. For negative statements these answers were scored inversely.

❖ Statistical Techniques Used

In order to analyze and interpret data, the following statistical techniques were used for the present study i.e. mean, frequency Distribution, Standard Deviation and y-ratio.

❖ Analysis and Interpretation of Data

For analysis and interpretation of data the study has been analyzed in different tables. The same is presented here.

Table-5.2 : Frequency Distribution of Attitude of Postgraduate Students towards Internet

(N=200)

Scores	Frequency	Percent of Students
150 and above	1	0.5
140-149	5	2.5
130-139	27	13.5
120-129	92	46
110-119	56	28
100-109	18	09
90-99	01	0.5

Table 5.2 shows that 0.5 percent students responded between 150 and above, 2.5 percent students responded between 140 and 149. While 13.5 percent students responded among

130 to 139, 46 percent students responded among 120 to 129. 28 percent students responded among 110 to 119, and 9 percent students responded among 100 to 109. Only 0.5 percent students responded was among 90 to 99. It is concluded from the above table that 99.5 percent responded with score above 96 indicating that almost all the students have favorable attitude towards the Internet (ICT). Thus hypothesis No. 1 that postgraduate students have a favorable attitude towards the Internet is accepted.

Table-5.3 : Difference between Attitude of Male and Female Postgraduate Students towards ICT

Sex	N	Mean	S.D.	t-ratio	Level of Significance
Male	132	122.04	9.52	0.26*	Insignificant
Female	68	121.67	9.24		

*Not significant at .05 level.

It can be observed from the table 5.3 that attitude of postgraduate male and female students towards the ICT has Mean scores 122.04 and 121.67, and Standard Deviation (S.D.) 9.52 and 9.24 respectively. The t-ratio between these two groups is 0.26, which is insignificant at 0.05 level. It indicates that male and female postgraduate students have similar attitude towards the ICT. Hence hypothesis No. 2 that there exists significant difference in the attitude of male and female students towards the ICT is rejected.

Table 5.4: Difference between Attitude of Rural & Urban Postgraduate Students towards ICT

Locality	N	Mean	S.D.	t-ratio	Level of Significance
Rural	114	123.30	7.51	0.72*	Insignificant
Urban	86	121.13	10.27		

*Not significant at .05 level.

Table 5.4 indicates that attitude of postgraduate students belonging to rural and urban areas towards the ICT has Mean scores 123.30 and 121.13, and Standard Deviation (SD) 7.51 and 10.27 respectively. The t-ratio between these two groups is 1.72, which is insignificant at 0.05 levels. It indicates that there is no significant difference in the attitude of rural and urban postgraduate students towards the ICT. Hence hypothesis No. 3 that there exists significant difference in the attitude of rural and urban postgraduate students towards the ICT is rejected.

Table 5.5: Difference between attitude of arts & science postgraduate students towards ICT

Streams	N	Mean	S.D.	t-ratio	Level of Significance
Arts	102	122.39	8.9	0.42*	Insignificant
Science	64	121.76	9.69		

*Not significant at .05 level.

It can be observed from the table 5.5 that attitude of postgraduate students belonging to Arts and Science streams has Mean scores 122.39 and 121.76, and Standard Deviation (S.D.) 8.9 and 9.69 respectively. The t-ratio between these two groups is 0.42, which is insignificant at .05 level. It indicates that there is no significant difference in the attitude of Arts and Science postgraduate students towards the ICT. Hence hypothesis No. 4 that there exists significant difference in the attitude of Arts and Science postgraduate students towards the ICT is rejected.

Table-5.6 : Difference between Attitude of Science & Commerce PG Students towards ICT

Streams	N	Mean	S.D.	t-ratio	Level of Significance
Science	64	121.76	9.63	0.46*	Insignificant
Commerce	34	120.76	10.32		

*Not significant at .05 level.

It can be observed from the table 5.6 that attitude of postgraduate students belonging to Science and Commerce streams has Mean scores 121.76 and 120.76, and Standard Deviation (S.D.) 9.63 and 10.32 respectively. The t-ratio between these two groups is 0.46, which is insignificant at 0.05 level. It indicates that there is no significant difference in the attitude of Science and Commerce postgraduate students towards the ICT. Hence hypothesis No. 5 that there exists significant difference in the attitude of Science and Commerce postgraduate students towards the ICT is rejected.

Table-5.7 : Difference between Attitude of Arts and Commerce PG Students towards ICT

Streams	N	Mean	S.D.	t-ratio	Level of Significance
Arts	102	122.39	8.92	0.82*	Insignificant
Commerce	34	120.76	10.32		

*Not significant at .05 level.

Table 7 shows that the attitude of postgraduate students belonging to Arts and Commerce streams has Mean scores 122.39 and 12.76, and Standard Deviation (S.D.) 8.92 and 10.32 respectively. The t-ratio between these two groups is 0.82, which is insignificant at 0.05 levels. It indicates that there is no significant difference in the attitude of Arts and Commerce postgraduate students towards the ICT. Hence hypothesis No. 6 that there exists significant difference in the attitude of Arts and Commerce postgraduate students towards the ICT is rejected.

5.5 Main findings of the Study

- The result of the study indicates that postgraduate students have more favorable attitude towards the ICT use in teaching.
- There is no significant difference between the attitude of male and female postgraduate students towards the ICT use in teaching.
- There is no significant difference between the attitude of rural and urban postgraduate students towards the ICT use in teaching.
- There is no significant difference between the attitude of Arts and Science postgraduate students towards the ICT use in teaching.
- There is no significant difference between the attitude of Science and Commerce postgraduate students towards the ICT use in teaching.
- There is no significant difference between the attitude of Arts and Commerce postgraduate students towards the ICT use in teaching.

5.6 Educational Implications of the Study

We are living in an information and knowledge-based society. The ICT has made an increasing and powerful impact upon every are3a and workplace like home, school, hospital, bank, research etc.; it has shown a great impact in the field of education. Most of the teachers and teacher-educators do not have an open mind on the use of ICT in general as well as for teaching purpose. The teachers and teacher-educators should be motivated to get training in the use of ICT. It can be done with the help of various types of workshops, which will develop in them a positive attitude towards ICT. Moreover, educational planners and administrators should be given proper orientation and practice in the use of ICT so that they can benefit from it.

One of the findings of the study shows that students have a favorable attitude towards the ICT. In this age of competition, students want to get the latest information not only in the field of academics but also in the field of jobs. So, the teachers and teacher-educators should motivate them to access different sites for different job opportunities. Another finding shows that there is no significant difference in the attitude of rural and urban postgraduate students towards the ICT. This finding indicates that locality (rural & urban) does not have any effect on the attitudes of postgraduate students. So, more and more seminars, conferences and workshops should be arranged for the learners so that they can update their knowledge with the help of the ICT. Not only this, it will help them to happily accept the different challenges of life coming in their way.

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CHAPTER - 6

Skills Education for Employment in Digital India

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6.1 Introduction

India, like any other knowledge economy, depends on the development of its educational sector. Higher education drives the competitiveness and employment generation in India. However, research findings have shown that the overall state of higher education is dismal in the country. There is a severe constraint on the availability of skilled labor. There exist socio-economic, cultural, time and geographical barriers for people who wish to pursue higher education. Innovative use of Information and Communication Technology can potentially solve this problem. Education is the driving force of economic and social development in any country. Considering this, it is necessary to find ways to make education of good quality, accessible and affordable to all, using the latest technology available to make it progressive in digital India.

The last two decades have witnessed a revolution caused by the rapid development using different skills in digital India. Different skills and technologies have changed the dynamics of various industries as well as influenced the way people interact and work in the society. Internet usage in home and work place has grown exponentially. For example ICT (Information and Communication) has the potential to remove the barriers that are causing the problems of low rate of education in any country. It can be used as a tool to overcome the issues of cost, less number of teachers, and poor quality of education as well as to overcome time and distance barriers.

India has a billion-plus population and a high proportion of the young and hence it has a large formal education system. The demand for education in developing countries like India has skyrocketed as education is still regarded as an important bridge of social, economic and political mobility. The challenges before the education system in India can be said to be of the following nature:

Access to education- There exist infrastructure, socio- economic, linguistic and physical barriers in India for people who wish to access education.

Quality of education- This includes infrastructure, teacher and the processes quality.

Resources allocated- Central and State Governments reserve about 3.5% of GDP for education as compared to the 6% that has been aimed. There exist drawbacks in general education in India as well as all over the world like lack of learning materials, teachers, remoteness of education facilities, high dropout rate etc .

Table 6.1: Participation of Indian students in education

Stage of education	Gross Enrolment Ratios (2003-04)
Elementary	85%
secondary	39%
tertiary stages of education	9%

(*Source*: Department of Higher Education, 2007)

Thus, the participation rates of the Indian population in education, and especially in higher education are quite low. In the current Information society, there is an emergence of lifelong learners as the shelf life of knowledge and information decreases. People have to access knowledge via ICT to keep pace with the latest developments. In such a scenario, education, which always plays a critical role in any economic and social growth of a country, becomes even more important. Education not only increases the productive skills of the individual but

Table 6.2: The four main rationales for introducing ICT in education:

Rationale	Basis
Social	Perceived role that technology now plays in society and the need for familiarizing students with technology.
Vocational	Preparing students for jobs that require skills in technology.
Catalytic	Utility of technology to improve performance and effectiveness in teaching, management and many other social activities.
Pedagogical	To utilize technology in enhancing learning, flexibility and efficiency in curriculum delivery

(*Source*: Cross and Adam (2007)

also his earning power. It gives him a sense of well being as well as capacity to absorb new ideas, increases his social interaction, gives access to improved health and provides several

more intangible benefits. The various kinds of ICT products available and having relevance to education, such as teleconferencing, email, audio conferencing, television lessons, radio broadcasts, interactive radio counseling, interactive voice response system, audiocassettes and CD ROMs etc have been used in education for different purposes

Today different technologies including laptops wirelessly connected to the Internet, personal digital assistants, low cost video cameras, and cell phones have become affordable, accessible and integrated in large sections of the society throughout the world. It can restructure organizations, promote collaboration, increase democratic participation of citizens, improve the transparency and responsiveness of governmental agencies, make education and health care more widely available, foster cultural creativity, and enhance the development in social integration. It is only through education and the integration of ICT in education that one can teach students to be participants in the growth process in this era of rapid change. ICT can be used as a tool in the process of education and for employment in the following ways:

- **Informative tool:** It provides vast amount of data in various formats such as audio, video, documents.
- **Situating tool:** It creates situations, which the student experiences in real life. Thus, simulation and virtual reality is possible.
- **Constructive tool:** To manipulate the data and generate analysis.
- **Communicative tool**: It can be used to remove communication barriers such as that of space and time.

The following mediums are used for the delivery and for conducting the education process:

- **Voice –** Instructional audio tools that include interactive technologies as well as the passive ones.
- **Video -** Instructional video tools that include still images, prerecorded moving images, and real-time moving images combined with audio conferencing.
- **Print –** instructional print formats that include textbooks, study guides, workbooks and case studies.

Different skills also allow for the creation of digital resources like digital libraries where the students, teachers and professionals can access research material and course material from any place at any time. Such facilities allow the networking of academics and researchers and hence sharing of scholarly material. This avoids duplication of work.

Use of computer in education develops higher order skills such as collaborating across time and place and solving complex real world problems. It improves the perception and understanding of the world of the student. Thus, ICT can be used to prepare the workforce for the information society and the new global economy.

E learning has the following advantages:

- Eliminating time barriers in education for learners as well as teachers
- Eliminating geographical barriers as learners can log on from any place
- Asynchronous interaction is made possible leading to thoughtful and creative interaction
- Enhanced group collaboration made possible via ICT
- New educational approaches can be used.
- It can provide speedy dissemination of education to target disadvantaged groups
- It offers the combination of education while balancing family and work life
- It enhances the international dimension of educational services
- It allows for just in time and just enough education for employees in organizations
- It can also be used for non-formal education like health campaigns and literacy campaigns

6.2 E learning and Education

E learning allows higher participation and greater interaction. It challenges the concept that face-to-face traditional education is superior to it. The web and the Internet is the core to spread education through e-learning. The components include e-portfolios, cyber infrastructures, digital libraries and online learning object repositories. All the above components create a digital identity of the student and connect all the stakeholders in the education. It also facilitates inter disciplinary research.

Plomp et al (2007) state that the experience of many teachers, who are early innovators, is that the use of computer and other skills are motivating for the students as well as for the teachers themselves. Bottino (2003) and Sharma (2003) mention that the use of ICT can improve performance, teaching, administration, and develop relevant skills in the disadvantaged communities. It also improves the quality of education by facilitating learning by doing, real time conversation, delayed time conversation, directed instruction, self-learning, problem solving, information seeking and analysis, and critical thinking, as well as the ability to communicate, collaborate and learn.

This can be used for the betterment of program delivery in terms of replication of best practices. It also helps researchers by provision of information, networking, online journals, libraries and data. The possibility of real time interaction in all the different aspects of the education system like teaching, collaboration, debates etc hold great promise for the future.

Evidence through practical experience in the world indicates that investing in experience contributes mainly to increasing human and knowledge capital, which benefits the industry as well. Employers gain from the increased knowledge and skills of staff without releasing them for long periods. In addition, investment in production of ICT is a more effective tool for development of the whole society. Research findings show that technology can support pedagogical, curricular, and assessment reforms, which intend to support the process of knowledge creation. Students and teachers plan their learning activities and build on each other's ideas to create new knowledge.

It also facilitates monitoring of their progress in understanding and preparation for lifelong learning and participation in the information society. Besides cost effectiveness, research has proved that ICT is most effective to tackle problems like expanding number of students in each class and in employment also. Technologies enabled distance education provides environmental benefits, as there is a major education in the amount of student travel. Economies of scale in utilization of the campus site are generated. Student housing is not needed which further saves costs. However, cost of providing the distance education depends on several factors, which include: geography and communities targeted, breadth of courses and class size. It also depends on the technology used; amount of resources deployed in producing course materials as well as how frequently they are updated.

E-learning allows delivery, dialogue and feedback over the Internet. It allows mass customization in terms of content and exams. E-education can provide access to the best gurus and the best practices or knowledge available. It is possible to leverage the online environment to facilitate teaching techniques like role-play across time and distance.

It can also facilitate the development of scenarios, which can be rarely witnessed in practice. ICT can play a valuable role to monitor and log the progress of the students across time, place and varied activities. Mooij (2007) states that differentiated skill based education can be expected to provide greater reliability, validity, and efficiency of data collection and greater ease of analysis, evaluation, and interpretation at any educational level. In absence

of different skills, most of the responsibility of teaching and learning lies on the teachers. However, with the help of ICT one can transfer the responsibilities to the students so that they can self manage. It helps to individualize the teaching or guidance method as per the student's need.

To summarize, the following table shows the main benefits of using information and technologies in education to the various stakeholders:

Table 6.3: Benefits of ICT in education to the main stakeholders

Stakeholder	Benefits
Student	▪ Increased access, ▪ Flexibility of content and delivery, ▪ Combination of work and education, ▪ Learner-centred approach, ▪ Higher quality of education and new ways of interaction.
Employers	▪ High quality, cost effective professional development in the workplace, ▪ Upgrading of employee skills, increased productivity, ▪ Development of a new learning culture, ▪ Sharing of costs and of training time with the employees, increased portability of training.
Governments	▪ Increase the capacity and cost effectiveness of education and training systems, ▪ To reach target groups with limited access to conventional education and training, ▪ To support and enhance the quality and relevance of existing educational structures, ▪ To ensure the connection of educational institutions and curricula to the emerging networks and information resources, ▪ To promote innovation and opportunities for lifelong learning.

***Source*: (UNESCO, 2002)**

It also boosts the confidence level and the self-esteem of the students who acquire the ICT skills through the process of being exposed to such kind of learning. Computer-based registration, evaluation, and administration help to link different levels of information and facilitate an overall view of the whole educational setup. It facilitates the evaluation and

examination of the learning process and results by the students and the parents in a flexible and convenient way. The globalization process has also created a large market of offshore students. To reach them, information technology is the only convenient medium, which can offer education as a service. It increases education provision substantially and can contribute to mass education. It also creates competition among the institutions for providing education and hence improves the quality.

India is making use of powerful combination of skills such as open source software, satellite technology, local language interfaces, easy to use human-computer interfaces, digital libraries, etc. with a long-term plan to reach the remotest of the villages. Community service centers have been started to promote e-learning throughout the country. Notable initiatives of use of skill in education in India include:

- Indira Gandhi National Open University (IGNOU) uses radio, television, and Internet technologies.
- National Programme on Technology Enhanced Learning: a concept similar to the open courseware initiative of MIT. It uses Internet and television technologies
- Eklavya initiative: Uses Internet and television to promote distance learning
- IIT-Kanpur has developed Brihaspati, an open source e-learning platform
- Premier institutions like IIM-Calcutta have entered into a strategic alliance with NIIT for providing programmes through virtual classrooms.
- Jadavpur University is using a mobile-learning centre
- IIT-Bombay has started the program of CDEEP (Centre for Distance Engineering Education Program) as emulated classroom interaction through the use of real time interactive satellite technology.
- One Laptop per Child (OLPC) in Maharashtra.

6.3 Factors affecting adoption of ICT in education and in Employment

There is a worldwide need felt for integrating into education in order to improve the pedagogy to reflect the societal change. The main goals of ICT adoption in the education field are reducing costs per student, making education more affordable and accessible, increasing enrollments, improving course quality, and meeting the needs of local employers. Low overheads and cost efficiency are attracting many private players in the field of Internet enabled education. This is also being driven by technological advances, competitive pressures and the positive experiences of many early adopters. The main factors that affect

the adoption of ICT in education are the mission or goal of a particular system, programs and curricula, teaching/learning strategies and techniques, learning material and resources, communication and interaction, support and delivery systems, students, tutors, staff and other experts, management, housing and equipment, and evaluation.

National vision, supported by coherent strategies and actions is the most important factor in integrating ICT in education. Successful implementation of education requires strong national support from government and local support from relevant institutions and education authorities. Sharma (2003) explains that the political powers of any nations affect the introduction of any new technology.

Sharma (2003) and Amutabi and Oketch (2003) explain that cost is an important issue that decides and guides the adoption and growth of Information and Communication Technology especially in developing countries.

Ozdemir and Abrevaya (2007) mention that the institutions, which are granted public status and are supported by government funds, as well as those, that are larger in size, are the ones to adopt the new technologies to support education. However, it is also observed that since technology adoption involves high fixed costs, institutes, which implemented such technology, did not upgrade it as time progressed. The presence of skill champion is necessary at all levels of the system. The strong presence of such leadership is evident wherever education integration has been initiated successfully (Mason, 2000).

Along with different skill training, one needs an technologies related support mechanism to gradually induce the integration. This is needed as many teachers in face of technical difficulties may tend to revert to the older teaching (non-ICT based) methods. Teachers need support in using and integratin into the curriculum and teaching methods. Teachers, who perceive greater ICT-related support being available to them, use technologies in their teaching much better.

6.4 Drawbacks of using more Technologies & Information in Education

Although skills offers a whole lot of benefits and in employment but there are some risks of using more technologies in education which have to be mitigated through proper mechanisms. They are:

1. It may create a digital divide within class as students who are more familiar with advanced skills will reap more benefits and learn faster than those who are not as technology savvy.

2. It may shift the attention from the primary goal of the learning process to developing ICT skills, which is the secondary goal.
3. It can affect the bonding process between the teacher and the student as moderated skills becomes a communication tool rather than face to face conversation and thus the transactional distance is increased.
4. Also since not all teachers are experts with technologies they may be lax in updating the course content online which can slow down the learning among students.
5. The potential of plagiarism is high as student can copy information rather than learning and developing their own skills.
6. There is a need for training all stakeholders in ICT.
7. The cost of hardware and software can be very high.

6.5 Summary and Conclusions

Changes in the curriculum do support fundamental economic and social transformation in the society. Such transformations require new kinds of skills, capabilities and attitudes, which can be developed by integrating skills in education. The overall literature suggests that successful technologies integration depends on many factors. National policies as well as school policies and actions taken have a deep impact on the same. Similarly, there needs to be an ICT plan, support and training to all the stakeholders involved in the integration. There needs to be shared vision among the various stakeholders and a collaborative approach should be adopted. Care should be taken to influence the attitudes and beliefs of all the stakeholders.

Skills can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would enable development of collaborative skills as well as knowledge creation skills. This in turn would better prepare the learners for lifelong learning as well as to join the industry. It can improve the quality of learning and thus contribute to the economy.

Similarly wider availability of best practices and best course material in education, which can be shared by means of different skills, can foster better teaching. However there exist some risks and drawbacks with introducing ICT in education which have to be mitigated. Successful

implementation of ICT to lead change is more about influencing and empowering teachers and supporting them in their engagement with students in learning rather than acquiring computer skills and obtaining software and equipment. Also proper controls and licensing should be ensured so that accountability, quality assurance, accreditation and consumer protection are taken care of. ICT enabled education will ultimately lead to the democratization of education.

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CHAPTER - 7

Green Technology & Techniques for Food and Agriculture

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7.1 Introduction

Technology that creates products and programs that help conserve natural resources and environment is known as green technology. Green Technology is another way of ensuring the reduction of environmental degradation that leads to increasing farm profits and protecting natural resources. It also reduces environmental degradation, which contributes to poverty reduction and sustainable agricultural development. Sustainable Agriculture can be described as a way to produce crops or livestock in an environmentally friendly manner, without damaging the farm. It also prevents adverse effects on water, soil, biodiversity, or other surrounding natural resources.

Therefore, this type of farming not only helps to conserve and protect the soil, water and climate but also ensures the development of biodiversity while protecting food and livelihood needs. Environmentally friendly technology and that is why it has been known as natural technology or clean technology. Clean technology or raw technology is the development and use of tools, systems and products used to save the environment and resources that reduce and reduce the negative impact of human activities. Raw technology has the potential to provide farmers with an adequate income from the production of high quality safe food. The green technology meets the following conditions:

(a) Reduces environmental degradation;
(b) Reduce greenhouse gas (GHG) emissions and its safe use and ultimately improve the health and well-being of all species.
(c) Conserves the use of natural resources and energy.
(d) Promotes the use of renewable resources.

Examples of green technology in India

- Cleaning dirty water
- Elimination of industrial emissions
- Recycling and waste management

- Private buildings
- Waste-to-Energy
- Generation of energy from the waves
- Vehicles that do not emit gases
- Harnessing solar energy

7.2 Goal of Green Technology

The goals of green technology are many. The ultimate goal of green technology is to meet the needs of the community in ways that do not harm or deplete the world's natural resources. It is necessary to find a destination to find out all about the purposes of this type of technology. The focus of raw technology is to make products that can be fully recovered or recycled. In addition, steps are being taken to reduce waste and pollution as one of the most important objectives of green technology by changing production and consumption patterns. In addition, it is necessary to develop other technologies to make something more difficult than any other environmental and health damage. The solution lies in the use of this type of technology to benefit and protect the planet. The key objectives of green technology include sustainable livelihoods, improving renewable energy, reducing waste production, conserving the use of natural resources, building recyclable and recycling products, and establishing alternative ecosystems.

7.2.1 Benefits of Green Technology

Some of the benefits of Green Technology

1) It does not emit anything that harms the environment.
2) It has become popular as technology consumers are more aware of the environment. This will provide benefits to investors over time in some areas.
3) It requires minimal maintenance costs. This reduces operating costs and that is why the total cost over time.
4) As it uses renewable natural resources so we will never run out of valuable resources such as water and electricity.
5) It will reduce the effects of global warming by reducing CO2 emissions.
6) You need a little adjustment

7.3 Challenges of Green Technology

The following are the disadvantages of Green Technology -

1) The initial investment or startup costs are very high.

2) People are unfamiliar with technology so it will take time to apply it to more people.

3) Technology is still evolving and many products are in the R&D phase. So people are not aware of the results of the operation.

4) Lack of skilled staff is available to install or use products or systems based on green technology.

5) In many countries policies have not yet been finalized with programs based on green technology

6) Competition

7) Side Effect

Agriculture plays an important role in meeting their needs in order to promote sustainability, providing food at the right rate for present and future generations. We use to evaluate the contribution of the latest technological changes to agricultural sustainability. These technologies have contributed to the dramatic increase in productivity and agricultural productivity.

Example - In order to meet the growing demand for food, new technologies developed through agricultural research and development are employed in agriculture. Green technologies, such as Integrated Pest Management, conservation farming and precision farming can increase productivity and profitability of farms, always reducing environmental degradation and conserving natural resources. Equally accurate farming can reduce the negative impact on the environment by using advanced technologies, such as global positioning system (GPS), precise data collection, and spatial information systems, making a more accurate map of fertilizer and pesticide requirements throughout the universe. Major applications of green technology are as follow.

- The energy sector
- The construction industry
- Water and waste management sector
- Transport sector
- The field of solar energy
- Strategies used in green technology for agriculture development

7.4 New Science and Technology

New technological innovations can improve the natural functioning of agricultural systems by innovating in engineering, technological know-how and biotechnology. New technologies

can reduce the burden of known toxins in agricultural production, replace safe alternatives, protect less or more water, conserve natural resources, reduce soil nutrients, reduce gas nitrogen loss and reduce the amount of renewable energy used in agriculture cycle. These new approaches mean changing current farming practices and using various technologies to improve productivity of resources.

(a) Biotechnology

Biotechnology is a field of applied biology that incorporates biological and bioprocesses processes into engineering, technology, medicine and other fields that require bio-products. Biotechnology can support sustainable development by improving the environmental efficiency of basic production and industrial processing and helping to repair damaged soil and water. Biotechnology is currently being used to develop new types of food, food and fiber plants with important genetic traits, such as: weed tolerance, pest resistance, agricultural features that improve yield and provide stress resistance, product quality that enhances taste and color and technological features such as chemical markers essential for reproduction.

(b) Applications for ICT / Global Positioning Systems / Precision Agriculture

Information and Communication Technology (ICT) has three distinct roles in green agriculture. Accurate farming, or agricultural precision, is a technology that collects and analyzes data to assess soil variability or climatic conditions, in order to guide the application of appropriate farming practices, in the right place, in the right way at the right time. It relies heavily on new technologies, including the Global Positioning System, sensors, satellite or aerial imagery, and information management tools, to gather information on flexible materials such as complete sowing, fertilization and other input requirements. This information is then used to apply flexible processes in salmon.

This has the potential to increase agricultural productivity and increase farm wages (through effective / low inputs), while at the same time reducing the cost of production and access to goods and services. The use of ICT in green agriculture to monitor land use patterns Effective ecosystems can be used to track the status of various environmental indicators and the impact of sustainable environmental management and protection. GIS and satellite remote play have played an important role in data collection, identifying sensitive and endangered forests, aquatic habitats and vulnerable marine ecosystems that are vital to life.

(iii) Bio-Production / Biofortification

Bio-production science covers a wide range of fields of agriculture, biochemistry, biotechnology, food science and bioengineering. .

(B) New Cultivation Systems

Organic farming and integrated pest control and alternatives use & variety of methods are employed for to increase agricultural productivity.

(i) Integrated Pest Control (IPM)

Integrated Pest Management (IPM) is an ecosystem that focuses on long-term pest control solutions through a combination of strategies such as biological control, habitat exploitation, agronomic modification processes, and the use of resistant varieties. IPM uses a whole series of procedures to reduce the need for chemical pesticides, including crop rotation; monitoring and monitoring of the presence and stage of pest growth; and the use of antimicrobial and dumb organisms, as well as live pesticides.

(ii) Organic Agriculture

Organic farming was developed as a holistic, ecosystem-based approach, considered as an alternative to what advocates see as irrational natural processes of conventional farming.

(iii) Green Technology Used in Organic Foods

The need for the production of organic food through strategies that is naturally sound, socially equitable, environmentally sustainable and economically viable.

(iv) Conservation Agriculture / Cultivation Cultivation / Crop Rotation

Conservation agriculture (CA) technologies involve minimum soil disturbance, permanent soil cover through crop residues or cover crops, and crop rotations for achieving higher productivity. In India, efforts to develop, refine and disseminate conservation-based agricultural technologies have been underway for nearly two decades and made significant progress since then even though there are several constraints that affect adoption of Conservation agriculture

(v) Water Management Systems

In Agriculture water is most widely used in most countries. As the population continues to grow, agriculture faces the enormous challenge of producing almost 50% more food by 2030

and doubling production by 2050. This will likely need to be achieved with less water, mainly because of growing pressures from urbanization, industrialization and climate change. It will be important in future for farmers to receive the right signals to increase water use efficiency and improve agricultural water management.

(vi) Natural Resource Management

Natural Resource Management refers to the management of natural resources such as land, water, soil, plants and animals, with a strong focus on how management affects the quality of life for both present and future generations.

(Vii) Green Technology for Multi-cropping and Crop Rotation

Multiple planting is a form of polyculture and can be defined as producing more than two crops at the same time, at the same time of year. It can be done in two ways namely; relay cropping, in which the next crop is sown and the first, before it is harvested and doubled, where the current crop is harvested and planted in sequence. On the other hand, the process of planting two or more different or unrelated plants in the same area at different times of the year is known as Crop rotation.

The main benefit of such programs is the maintenance of the earth's crust, which is depleted by inland farming. These farming methods are aimed at a non-destructive environment with improved organic food production. Unlike conventional farming, this system has a great impact on harmonious relationships in plants as they have high biological, visible soils and several chemical quality conditions.

(VIII) Green Technology of Biogas and Organic Fertilizers

This green technology uses biological agricultural waste and converts it into fuel and fertilizer. Organic waste is converted into biogas and residues by anaerobic digestion. Biogas is a well-known renewable energy source used for lighting, cooking or maintaining the temperature inside the greenhouse to grow the most suitable vegetables, while the product is used for food production of natural plants .Residues are the result of the mineral processing process and can be used to increase crop yields and soil fertility as they are rich in nutrients and have good soil penetration capacity. It is considered to be a substitute for chemical fertilizers and is good for natural agricultural plants as it reduces the odor by up to 80% from the stock.

(Ix) Green Mixed Agricultural Technology

Mixed farming is considered to be the most common method used in organic farming. One of the best methods of mixing occurs when plant residues are used to feed the animal and animal feces are used as plant fertilizer for plants. Mixed farming provides farmers with a good opportunity to reduce the risk of single crop production and labor utilization.

7.5 Possible Green Technologies

Some of the selected renewable energy technologies are

A) Solar Photovoltaic: Solar photovoltaic technology converts sunlight into electricity using semi conductor modules. Commonly used to meet lighting needs, Green Technological Values and Energy Efficiency can also be used to pump water, refrigerator, connectors, and charge batteries. Solar photovoltaic has the potential to serve as a green energy source for water pumping, street lighting, lighting in rural homes and pest control. As technology successfully produces low-cost, high-energy photovoltaic cells, this new generation of solar power could become one of the most affordable and efficient energy sources in the future.

B) Wind Power: Wind power is in the boom cycle. Its value increases in the sense that when compared with other sources; wind power produces a few pollutants or greenhouse gases. Wind turbine electric or mechanical power generation is a proven technology. Located in 75% of the world, wind turbines of 900 W to 50 kW can be used without a grid to pump and purify drinking water, irrigation, telecommunications, homes, schools, clinics and the addition of large power stations. The wind turbines used to pump irrigation water can increase agricultural growth without emitting carbon emissions.

C) Bio-fuel: Bio-fuel such as bio-ethanol and bio diesel has the potential to take an important portfolio of future energy plants. Monitoring is mandatory in testing biofuel. l as a green agricultural technology. Concerns about food security and environmental hazards and biodiversity are the limits that need to be met when analyzing sustainable agricultural interactions with bio-fuel. In addition, the transformation of desert lands into agricultural land by selecting certain crops can be viewed as positive effects.

D) Biogas: Bio gas is a product of the anaerobic digestion of organisms by metanogenic bacteria. Bio gas is justified by the fact that this technology uses organic agricultural waste and converts it into fuel and fertilizer. The direct effects of natural gas are wood fuel,

agricultural residues, livestock manure and paraffin savings. Increases in soil fertility and crop production have also been observed. Natural gas also solves the problem of indoor air pollution and improves domestic or public sanitation. The potential for living gas in India is estimated at 12 million natural gas plants.

E) Small and Medium Electricity: A national renewable energy generation conference is international in nature. Power plants ranging from a maximum capacity of 500 kW in Nepal to 25 MW in India are considered to be renewable. Commonly used in rural areas for electrification, hydropower industries can play an equally important role in assisting with irrigation and value addition to agricultural products.

F) Biomass: Agricultural residues and waste are converted into electrical and thermal energy by processes such as heating, gas installation, and integration. Biomass technology recommends normal crop production and reduces or completely eliminates the use of conventional fuel. International experience demonstrates biomass as an effective way to increase agricultural income and conserve limited resources.

G) Solar Thermal, Improvement Water Mill, and Geothermal Energy : These clean technologies are found to contribute to increasing the value of agricultural products. Food processing, animal husbandry, dairy, and aquaculture are the areas identified for using solar water heaters and research on solar drying of agricultural products, including paddy, coffee beans, tobacco, nuts, bananas, bamboo, rubber, etc.

7.6 Concepts of Green Technology Adoption in Future in field of Agriculture Development

Green Technology is more expensive than technology that aims to replace it. The cost of training and development can make it more expensive compared to the available technology. The perceived benefits also depend on a number of factors such as location, human resource skills, technological readiness and supporting infrastructure.

Therefore, what may be green technology that is possible in one country or region may not be in another. The adoption and spread of these programs can be prevented by many other obstacles. The green technology solution is to use green technology but poor countries have not been able to use functional technology on a large scale since they cannot afford the existing ones. Efforts are needed to make this technology accessible to all. Today, efforts are

being made to increase agricultural productivity while reducing the decline in existing resources beyond the level of sustainability by adopting Green Technologies. Efforts to develop indigenous energy resources are critical to developing a culture of using environmentally friendly energy resources.

There is a need to design effective communication systems for awareness. It is important to note that wind turbines and solar photovoltaic systems are temporary and weather-dependent sources. Taking the cost factor as the center point, these are not the right solution for agricultural families. At the community level, the use of wind turbine and photovoltaic systems is possible with the help of technology and access to credit permitted to use technology especially in storage areas such as depots, cold storage areas, etc. A source of energy in the form of electricity from small wind and the sun photovoltaic has been found to contribute to farmers' income and savings.

These technologies reduce health risks from indoor air pollution and the costs incurred in purchasing commercial fuel. Therefore, in view of long-term growth, an improved public investment policy is recommended to improve these processes. The abolition of pesticide subsidies cuts in the production of basic pesticides, strict planning between national and international agencies and the diversification of funds previously spent on chemicals in human resources

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CHAPTER - 08

Agriculture Extension and Modernization of Technologies to improve Farming for Rural Areas

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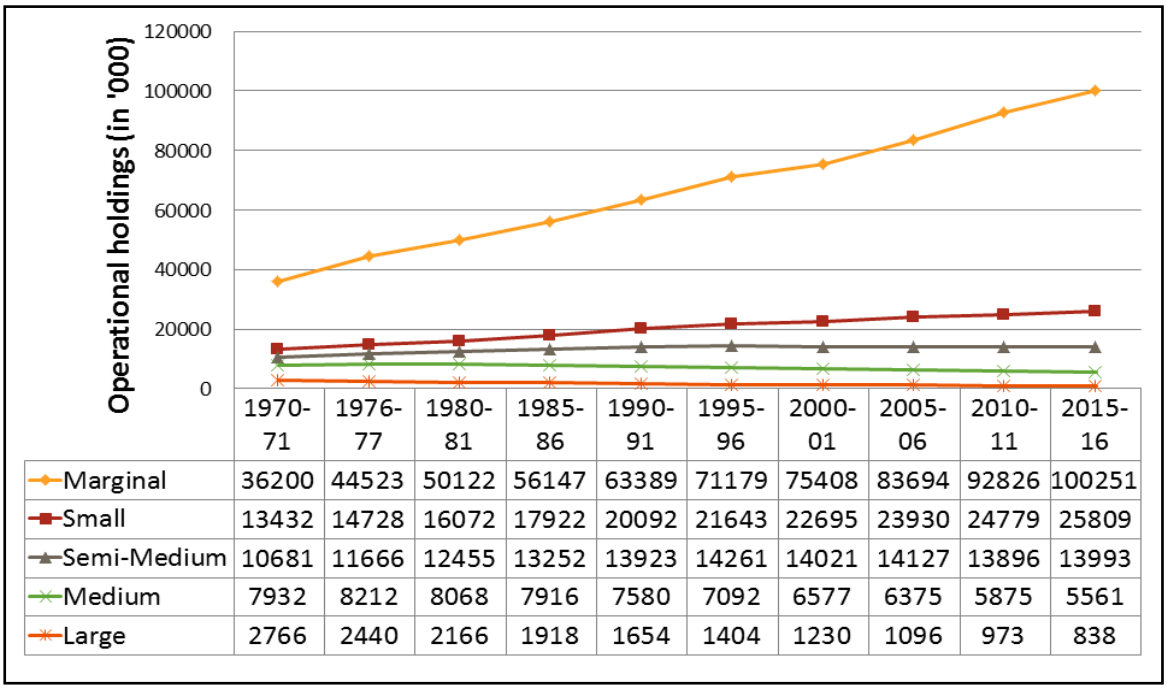
8.1 Introduction

India is predominantly an agrarian economy. Farming contributes about 17% to India's GDP and about 60% of the country's rural households depend on agriculture and its associated industries. Despite having the second-largest arable land parcel, its 160 million hectares make it second only to the US. India is way behind some developed, as well as developing, countries in terms of productivity. Low productivity in the sector is the result of various structural challenges, including heavy dependence on rainwater for irrigation, small-farm land holdings and lack of access to technology and real-time information. Around 70% of the agricultural households in India (mostly small farmers with average land holdings of less than one hectare) struggle to make ends meet and depend on loans for their farming activities. The demand for food in India is growing. That trend is likely to continue as disposable incomes increase and changes in consumption patterns favour value-added foods.

However, supply is constrained by marginal productivity gains in a majority of crops, the shrinking amount of arable land, erratic monsoon patterns, climate change effects and inherent supply chain inefficiencies that lead to waste. And the reduction of available labour in the agricultural field makes the situation worse. Given the importance of agriculture in India, both the government and private players are working to improve the efficiency and productivity of Indian agriculture and exploring how farming may be a solution for respective economic development.

Not only agriculture contributes with 17% of India's GDP but also it provides livelihood for 50% of our population and constitutes about 400B US$ of economic value. Despite being among top global producer of Pulses, Rice, Milk, Jute etc., our Agri value chain is widely acknowledged to be among the most broken and inefficient globally. There are three

primary issues here – (1) Level of farm mechanization is about 35-40% in India while most developed countries have over 90% mechanization, (2) farmer value realisation (What % of final consumer price goes to farmer) is between 20–30% versus global benchmark of 50-60% and (3) food processing is still less than 15% in India compared to global averages of 30–40%. Farmers are significantly facing pressures to feed an ever-growing population and their challenges are far more complex due to the complicated agricultural value chain.



	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2015-16
Marginal	36200	44523	50122	56147	63389	71179	75408	83694	92826	100251
Small	13432	14728	16072	17922	20092	21643	22695	23930	24779	25809
Semi-Medium	10681	11666	12455	13252	13923	14261	14021	14127	13896	13993
Medium	7932	8212	8068	7916	7580	7092	6577	6375	5875	5561
Large	2766	2440	2166	1918	1654	1404	1230	1096	973	838

Figure 8.1 : Operation holding in India

Apart from an apt foresight and good judgment, there is an acute need to adopt modern, sustainable farming practices backed by technology in order to ensure a steady flow of income for farmers looking at the current challenging economy. Each of these underlying factors are about to change and it may create impact far bigger than the unicorns. A combination of factors is responsible for this

- Rise of Indian Consumer
- Data Revolution in Rural India
- Push to Double Farm Income by 2022
- Advanced technologies like Artificial Intelligence (AI), blockchain, remote sensing, Unmanned Aerial Vehicles (UAVs), multispectral images, cloud computing systems etc

Agriculture continues to be the most important sector of Indian Economy. Research, extension and farmers efforts are all contributed significantly from 50 million tonnes in 1950-51 to land mark achievement of an estimated production of 241 million tonnes of food production in 2010-11. The total demand for food grains is projected to touch 280 million tonnes by the year 2020-21. Meeting his demand will necessitate a growth rate of nearly 2 per cent per annum in food grain production (Singh, 2011) and agriculture sector need to grow targeted 4 per cent per annum

8.2 Covid-19 Pandemic and Digital Agriculture

The Covid-19 pandemic has in a way created an urgency to amplify the digital agriculture growth in India and this is possible when we create robust rural connectivity since most farmers and land holdings are based out of villages. One of the key aspects for farmers to go digital is by upgrading themselves with low-cost smartphones and tablets equipped with GPS, which crucially supports the flow of information

Figure 8.1 : IoT Technology and Form Management

Technology plays a key role in increasing productivity as it will deliver customised solutions to farmers based on crop's sowing date, variety sown, harvest date, soil health, disease outbreaks, pest control measures, water availability, projected weather conditions as well as market prices. One of the key aspects for farmers to go digital is by upgrading themselves

with low-cost smartphones and tablets equipped with GPS, which crucially supports the flow of information. Information & Communication Technology (ICT) and Internet of Things (IoT) is capable of delivering real-time, targeted information which in return will maximise profits and minimise losses. Mobile phones enable farmers to integrate and operate in structured markets and no longer become victims of distress sale by selling in saturated markets that are not based on standards. Through implementation of intelligent software and hardware, farmers will be in a position to make quick, timely and informed decisions regarding quality crop production. In short, pre-harvest and post-harvest management systems will provide relevant insights to optimise productivity and mitigate the impact of unpredictable variables for farmers. Digital Avenue created for farmers is in the proliferation of online marketing platforms that provide farmers with unrestricted market access, collaborative profits and help eliminate intermediaries.

Figure 8.2 : IoT application Agricultural Marketing

Farmers can easily access these portals via their mobile phones. With the help of the internet, they can even browse for specific information pertaining to current market prices, weather conditions or any crop-related facts. With the aid of these forecasts, farmers can more than double the yield.

Digital agriculture will help break the monopoly and decentralise the pricing mechanism and reduce transaction costs thus ensuring higher returns to farmers for their produce. Since agriculture is a dynamic data-driven sector, digital tools can dramatically improve the

livelihood of farmers by protecting them against price volatility. A digitised farmer will naturally adopt 'precision farming' which will be sustainable in the long run with the help of technology. The quality crops produced can be distributed effectively through the supply chain using the best preservation and storage methods. To top it, having food safety systems and facilities in place to track supply chains will also boost the overall value of the agriculture sector. Digitized farmers' will significantly contribute in realising the dream of an 'atmanirbhar bharat' or self-reliant India in the coming years. The socio-economic potential and impact of rolling out electronic governance software and mobile applications in rural India is much more than urban India. The Digital India agenda has created opportunities for many ministries and departments of the government to come together and develop integrated solutions. But many technology providers, and indeed even some policy planners, have begun to consider Digital India opportunity as synonymous to the development of smart cities and the "Internet of Everything"

Figure 8.3 : Digital Technology in Agriculture for Socio-Economic Potential

8.3 Rural India Digitization

With more than 600 million internet users in 2019, India is one of the largest and the fastest growing markets for digital consumers. This substantial growth of digital economy was largely led by consumers in the urban region. However, with the government's push towards financial inclusion, rural India have also started embracing the digital economy. As per the

TRAI report, rural internet subscribers account for more than 38% of the total internet subscribers in the country as of March 2020, increasing from about 32% in March 2017. Rural India is an important part of the country's economy and contributes about 46% of the national income. It is estimated that about 66% of India's population is rural and despite the rapid rise of urbanization, rural India will continue to account for a significant portion of India's population in the next decade. Despite the growing number of internet users in rural India, there exists a significant digital divide between urban and rural India.

Figure 8.4 : E-Chaupal and Digital India

As per the latest TRAI report, internet penetration in rural India was only about 33% compared to 99% in Urban India. This gap mainly stems from two factors lack of infrastructure and awareness. To bridge the gap, the Indian government has launched the "Digital India" programme One of the major objectives of the programme is to improve digital infrastructure in the country and particularly in Rural India. To improve digital awareness, the Indian government launched 'Pradhan Mantri Gramin Digital Saksharta Abhiyan' under the 'Digital India' initiative with an aim to make six crore Indians residing in rural India digitally literate. These initiatives by the government are expected to have a positive impact for the digitization of rural India. Two of the sectors that are stated to benefit from the digitization initiative are the agriculture and the financial sector.

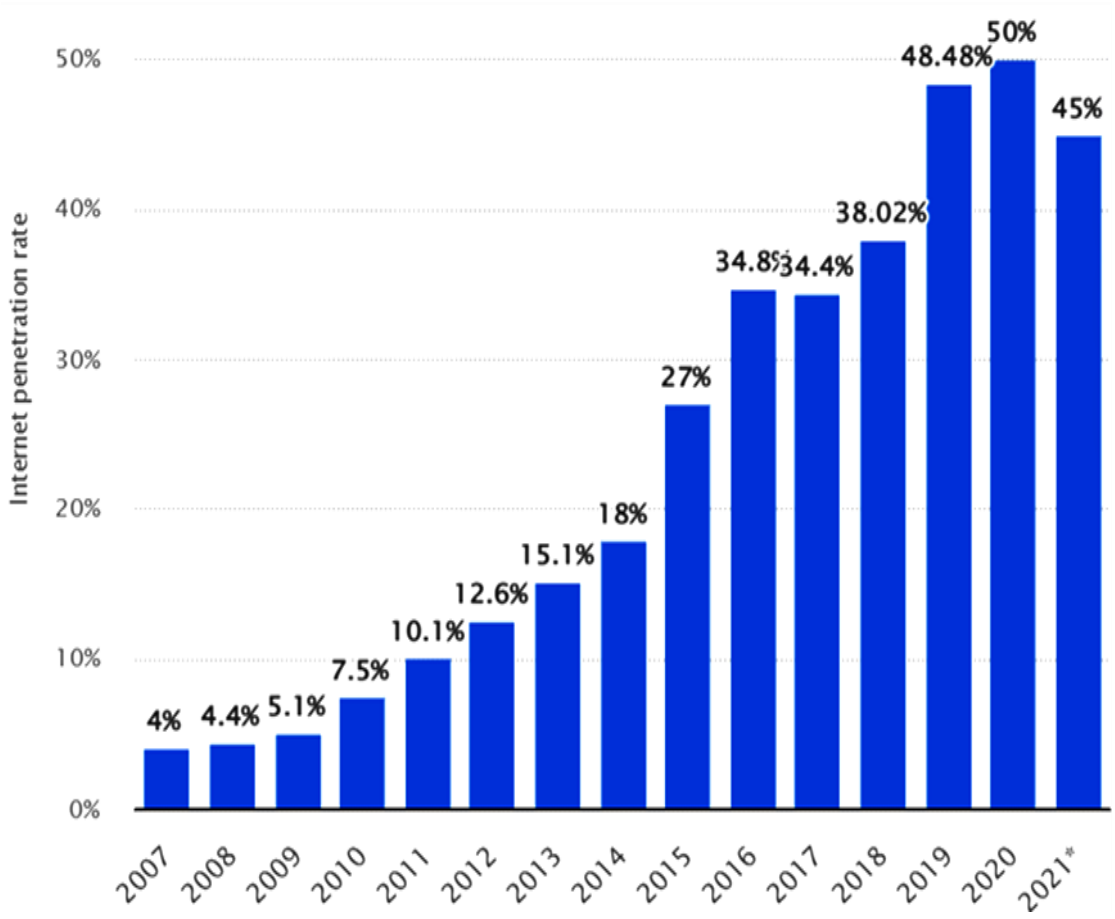


Figure 8.5 : Internet penetration in India (As per TRAI Report 2021)

8.4 Agriculture Sector and Rural Financial Sector

Agriculture sector represents about 18% of India's GDP and accounts for more than 50% of the total workforce. Despite the sector's significant contribution, India's agriculture sector is highly dependent on human labour and good rainfall unlike the agriculture sector in developed economies that rely on mechanized farming and better planning. Realizing that technological agricultural systems are the need of the hour, the Indian government has launched the 'Kisan Suvidha' app which has about 100 million registered users.

This app assists farmers with relevant information on the weather of the current day and next five days, market prices, dealers, agro advisories, and plant protection. Sensing the huge potential, a few start-ups like SatSure, CropIn, Niruthi, AgRisk are also entering the space. These startups along with the digital government programmes help the farmers in

sowing and crop monitoring, capturing and analyzing various data points, including crop, soil, and weather data, all of which can assist in decision making and facilitate access to crop insurance and institutional credit.

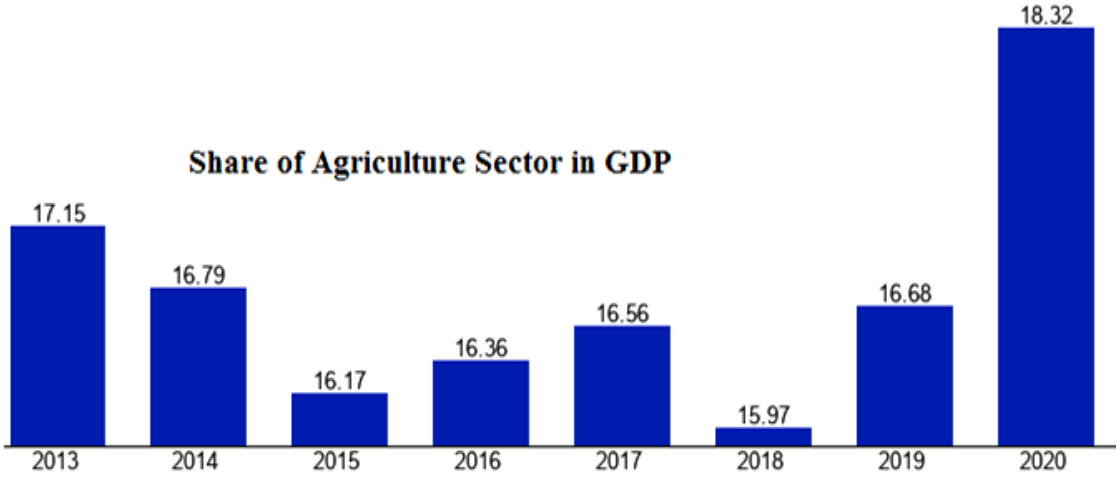


Figure 8.6 : India GDP share of agriculture

While agriculture presents a huge opportunity, the rural financial sector is also on the cusp of digital revolution. Over the last five to six years, several policy and financial initiatives aimed at inclusive rural growth have been rolled out by the government. Aadhaar, a unique biometric identifier, zero balance Jan Dhan savings bank accounts, direct transfer of social benefit payments, and the digital payment infrastructure BHIM are just some of them.

The bank account penetration increased from 54% in 2014 to 80% in 2018 on the back of these initiatives. Increase in banking penetration presents a significant opportunity for the start-ups and the incumbent players specially in the payments and distribution of financial products space. Start-ups like Jai Kisan and FIA technology are bridging the digital gap in rural India by offering financial products and services. Incumbent players, like Paytm have also expanded their services and claims to have presence in more than 3 lakh villages across India. The company also claims to have on-boarded more than 30 lakh merchants accepting digital payments in smaller towns.

Sensing that the internet connectivity is a big hurdle for digital payments in rural India, the Reserve Bank of India (RBI) is also pushing forward for offline solutions. Offline payments are transactions that are either processed without a data connection or where the transaction is recorded offline and processed at a different point of time. In August 2020, RBI rolled out a

pilot scheme for small value payments (maximum up to Rs 200) in offline mode at retail outlets. A few payment companies have already started developing offline solutions before the RBI announcement. Google Pay partnered with Pine Labs in 2019 to allow merchants to initiate payment requests by punching in a customer's mobile number on their PoS devices, while Paytm launched a Tap-to-Pay card (NFC based) in 2018, through which customers could load money onto the card, with or without the internet, and pay merchants by tapping the card on the merchants' terminal.

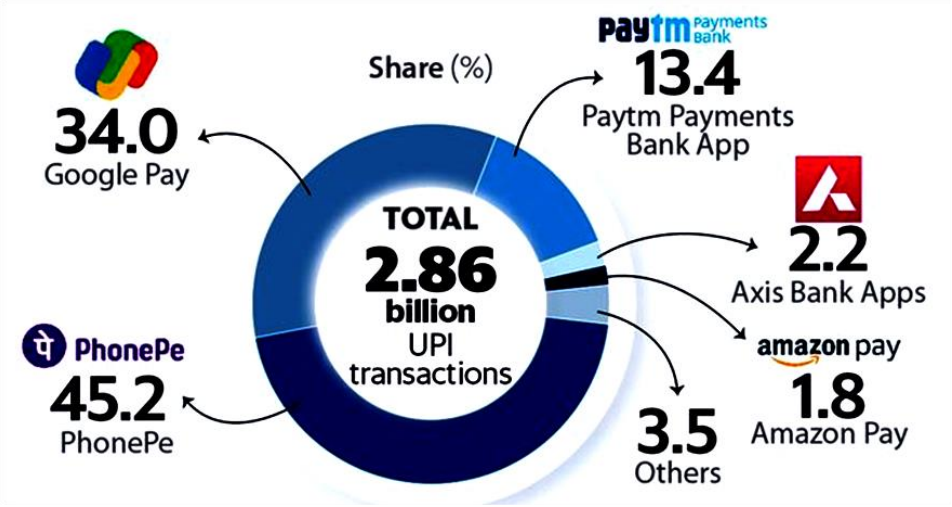


Figure 8.7 : Share in total UPI transactions volumes (June, 2021)

These initiatives by the government and the effort from the private sector are huge steps towards digitizing rural India, but touch just a fraction of the rural population. As smartphone penetration and mobile data usage grows in rural India, governments, regulatory bodies, financial service providers and fintech companies need to collaborate to unlock the potential of a digital rural India. The next few years will witness the increased deployment of new digital technologies like big data analytics, machine learning, blockchain, cloud computing and artificial intelligence (AI) which will be used to offer products beyond cities and in rural areas.

8.5 Government Initiative

The Government has set a target of doubling of farmers' income by the year 2022. The Government has constituted an Inter-Ministerial Committee to examine issues relating to doubling of farmers' income and recommend a strategy to achieve doubling of farmers'

income in real terms by the year 2022. The committee has, inter-alia, appreciated the role of Digital Technology, which can play a transformational role in modernizing and organizing how rural India performs it's agricultural activities. The technologies include Artificial Intelligence, Big Data Analytics, Block chain Technology, Internet of Things etc. The deployment of technology is very important to make schemes of the Ministry successful. Development of Kisan Suvidha mobile application to facilitate dissemination of information to farmers on the critical parameters viz., Weather; Market Prices; Plant Protection; input Dealers (Seed, Pesticide, Fertilizer) Farm Machinery; Soil Health Card; Cold Storages & Godowns, Veterinary Centres and Diagnostic Labs. With market information, Farmers are better informed about markets to sell produce, prevailing market prices and quantity demanded in the market. Thus, they can make informed decisions to sell produce at the right price and right time.

The Indian Council of Agriculture Research (ICAR) has also compiled more than 100 mobile apps developed by ICAR, State Agricultural Universities and Krishi Vigyan Kendras and uploaded on its website. These mobile apps developed in the areas of crops, horticulture, veterinary, dairy, poultry, fisheries, natural resources management and integrated subjects, offer valuable information to the farmers, including package of practices, market prices of various commodities, weather related information, advisory services, etc.

a) Development of mKisan Portal *(www.mkisan.gov.in)* for sending advisories on various crop related matter to the registered farmers through SMSs**.**

b) Launching of e-National Agriculture Market initiative to provide farmers an electronic online trading platform.

c) Implementation of Agricultural Marketing Infrastructure, sub-scheme of Integrated Scheme of Agricultural Marketing, in order to improve/create scientific storage capacity for storing farm produce, processed farm produce and to reduce post-harvest storage loss.

d) Introduction of Soil Health Card Scheme to assist State Governments in providing Soil Health Cards to all farmers across the country once in a cycle of 2 years Soil health card provides information to the farmers on nutrient status of their soil along with recommendations on appropriate dosage of nutrients to be applied for improving crop productivity and soil fertility.

e) Providing subsidies under National Food Security Mission (Oil Seeds and Oil Palm) to farmers on seed components, transfer of technologies, production inputs and water carrying devices. Financial assistance is also being provided under this scheme for block demonstration, frontline demonstration, farmers training to educate farmers to adopt modern techniques of farming to yield good crop economically.

f) Use of space technology for various programmes/ areas such as Forecasting Agricultural Output using Space, Agro-meteorology and Land-based Observations project, Coordinated programame on Horticulture Assessment and Management using geo-informatics project, National Agricultural Drought Assessment and Monitoring System, Rice-Fallow Area Mapping and intensification, geo tagging of infrastructure and assets created under Rashtriya Krishi Vikas Yojana, and Crop Insurance.

g) Using machine learning process along with different computer algorithm for crop classification and area estimation.

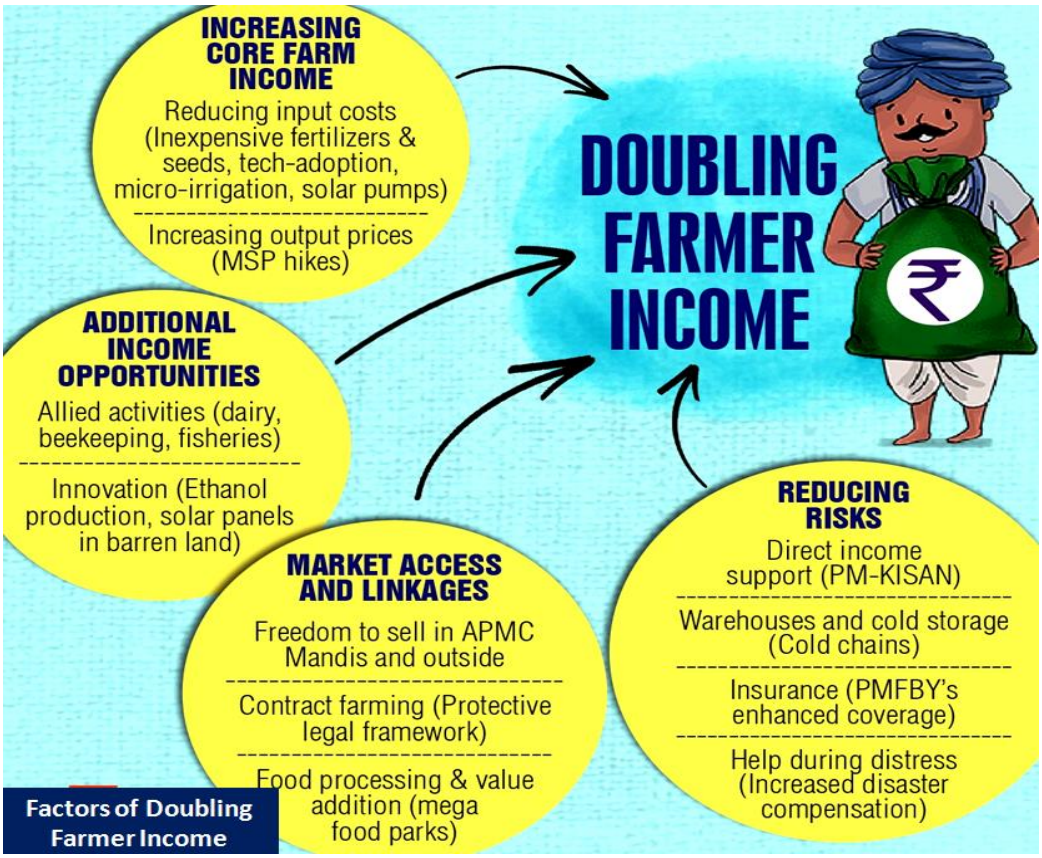


Figure 8.7 : Factors of doubling farmer's Income in rural India

The Government has also set up 713 Krishi Vigyan Kendras and 684 Agricultural Technology Management Agencies at district level for dissemination of technologies among farm community. In addition, farmers are provided information through Focused Publicity Campaigns, Kisan Call Centres, Agri-Clinics and Agri-Business Centres of entrepreneurs, Agri Fairs and exhibitions, Kisan SMS Portal, etc.

8.6 Technology Applications in Agriculture Sector

In India, agriculture supports 58% of the population. Around 51% of India's geographical area is under cultivation. A major share of its GDP comes from agriculture sector. Government recently launched some major schemes like crop insurance, per drop more crop, Rashtriya Krishi Vikas Yojna to enhance the productivity of the crops. Initiatives like organic farming and increase in the production of pulses are also been taken.

Balancing the inputs and outputs on a crop farm is essential to its success and cost-effectiveness. The ability of GIS to study and envisage agricultural environments and workflows has proved to be favourable to those involved in the farming industry. While natural inputs in farming cannot be measured but, can be better understood and managed with GIS applications such as crop yield estimates, soil amendment analysis, erosion identification and remediation.

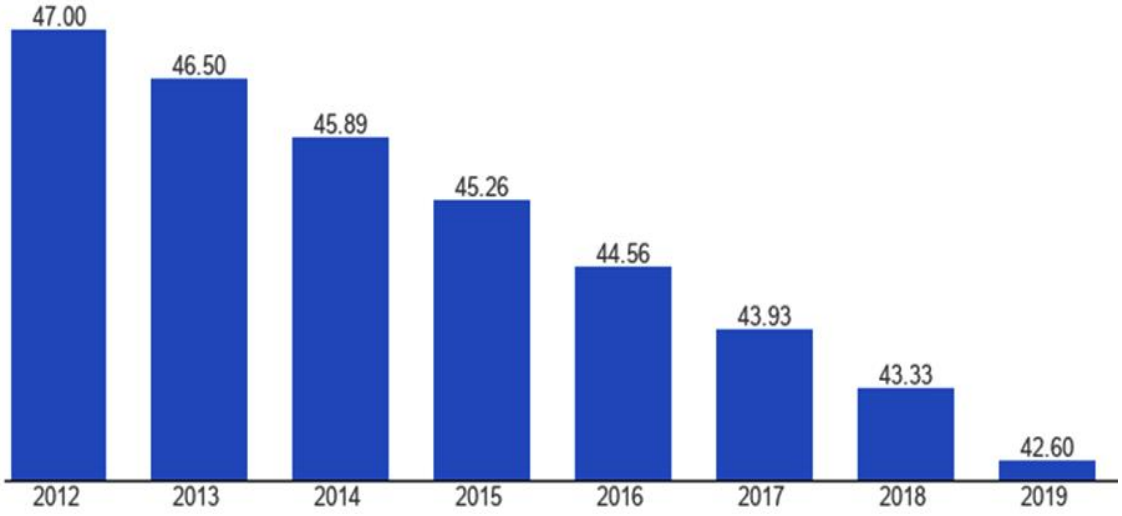


Figure 8.8 : Employment in agriculture, % of total employment

Agricultural plants, as living organisms require water and nutrients in order to grow and are sensitive to extreme weather phenomena, diseases and pests. Remote sensing can provide

data that helps identify and monitor crops. When these data is organised in a Geographical Information System (GIS) along with other parameters, they become an important tool that helps in making decisions about crops and agricultural strategies.

Over the past few decades, Remote Sensing and GIS have grown exponentially in many sectors for visualization, monitoring, management, and potential development. Remote Sensing and GIS technology enable agencies to get reliable information of natural and man-made features or processed and interpreted appropriately phenomenon occurring over the earth's surface without making any physical contact. Nowadays, farmers rely on these technological improvements.

- **Crop Sown Area Estimation using** Satellite data such as Sentinel-1, 2, Landsat-8, World View-3, LISS-IV etc
- Assessment of vegetation dynamics using **Normalized Difference Vegetation Index (NDVI)**
- **Crop Diseases Identification using image analysis**
- **Monitering of Soil Properties** like pH, organic matter, texture, Water content availability etc.

  Flood damage assessment improves the role of land use planning in managing flood risk.
- Natural Catastrophe modeling is a system to estimate the real-time or possible forecast of risk assessment

Drone Image Analysis for Crop Damage Assessment

- Crop production and yield over a given area
- Assessment of Crop Damage and Crop Progress
- Crop Acreage Estimation
- Identification of Pests and Disease Infestation
- Water Resources Mapping
- Monitoring of Droughts

8.6.1 Television

Agricultural programmes on television started with introduction of Krishi Darshan programme in DD National channel on January 26, 1967. With the launching of satellite instructional television experiment in 1975 and Indian satellite in 1982, these programmes became familiar to a vast majority of rural viewers and Krishi Darshan was the first rural

program. This programme created awareness among the rural viewers and acquainted them with the latest technical and scientific knowledge with regard to crop cultivation practices, use of fertilizers, soil testing, dairying animal husbandry, sericulture, horticulture, fishery, poultry, weather forecasts, etc. Television informs the farmers about weather forecast as well as use of pesticide and indicates about flood situation and environmental changes in area. It is one of the powerful channels of the mass media, which transmit information very fast about agricultural technology among the farmers community.

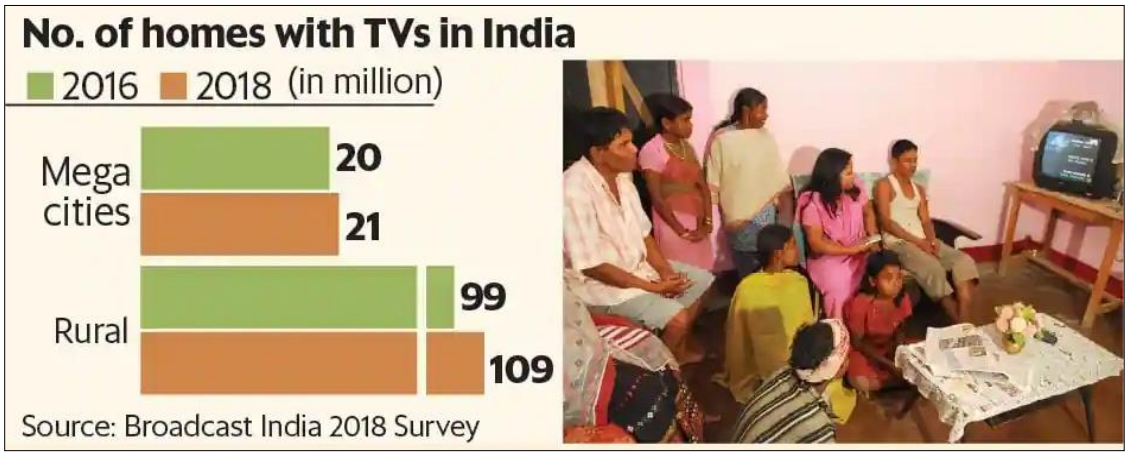


Figure 8.9 : TVs in homes in Rural India

8.6.2 Mobile Applications

Mobile access to technology is one of the most important enablers for small holders to improve productivity sustainably. Innovative mechanisms for technology transfer are required to bring relevant tools, knowledge and knowhow to farmers. ICT applications can foster dissemination of information on technology, market demand, price information, weather, pest, and risk-management information, best practices to meet quality and certification standards. Farmer Call Centre (Kissan Call Centre) the Department of Agriculture & Cooperation (DoA&C), Ministry of Agriculture, Government of India launched Farmer Call Centres across the country on January 21, 2004, to deliver extension services to the farming community. The purpose of these call centres is to respond to issues raised by farmers, instantly, in the local language. National level universal eleven digit number 1800-180-1551 has been allotted for Kissan Call Centre. The number is accessible through all mobile phones and landlines of all telecom networks including private service providers. Calls are attended from 6.00 AM to 10.00 PM on all seven days of the week at each KCC location.

Figure 8.10 : Mobile Applications in form Management

8.6.3 Agricultural Drones

Technology has changed over time and agricultural drones are a very good example of this. Today, agriculture is one of the major industries to incorporate drones. Drones are being used in agriculture in order to enhance various agricultural practices. The ways ground-based and aerial-based drones are being used in agriculture are crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis.

The major benefits of using drones include crop health imaging, integrated GIS mapping, ease of use, saves time, and the potential to increase yields. With strategy and planning based on real-time data collection and processing, drone technology will give a high-tech makeover to the agriculture industry. From the drone data, we can draw insights regarding plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, field water ponding mapping, scouting reports, stockpile measuring, chlorophyll measurement, nitrogen content in wheat, drainage mapping, weed pressure mapping, and so on.

Figure 8.11 : Agricultural Drones and Agricultural Practices

8.6.4 Livestock Monitoring

Livestock management refers to the activities carried out by a farmer in his effort to raise farm animals from day old to the point of marketing or disposing the animals. It involves the provision and maintenance of adequate housing, good feeding, sanitation and medicare. While the animal consumes its feed ration through a sensor-controlled mechanical arm, the animal is milked. New robots have the ability to build a personal file for each cow, which allows for the control of their origin, age, milk quality or the animal's health condition. Large farm owners can utilize wireless IoT applications to collect data regarding the location, well-being, and health of their cattle. This information helps them in identifying animals that are sick so they can be separated from the herd, thereby preventing the spread of disease. It also lowers labor costs as ranchers can locate their cattle with the help of IoT based sensors.

IoT-enabled livestock management solutions take the guesswork out of herd health. Using a wearable collar or tag, battery-powered sensors monitor the location, temperature, blood pressure and heart rate of animals and wirelessly send the data in near-real-time to farmers' devices. Advancing farming technology in the cattle industry allows farmers to maximise

their time and produce a better product with less waste. Additionally, it allows the public and those in the cattle industry to become closer as prejudice and stereotypes are addressed.

Figure 8.12 : Livestock Monitoring using IoT Device

8.6.5 Role of IoT in Agriculture

Smart Agriculture Using IOT Agriculture is the main backbone of India's Economical growth. The most important barrier that arises in traditional farming is climatic change. The number of effects of climatic change includes heavy rainfall, most intense storm and heat waves, less rainfall etc. Due to these the productivity decreases to major extent. Climatic change also raises the environmental consequences such as seasonal changes in life cycle of plants. To boost the productivity and minimize the barriers in agriculture field, there is need to use innovative technology and techniques called Internet of Things.

Today, the Internet of Things (IoT) is transforming towards agriculture industry and enabling farmers to compete with the enormous challenges they face. Farmers can get huge information and knowledge about recent trends and technology using IoT. The smart agriculture market is expected to reach $18.45 Billion in 2022, at a CAGR of 13.8%. It is estimated that 75 million IoT devices has been be shipped for agricultural uses in 2020, at a

CAGR of 20%. IoT devices can be of great help in enhancing the production and yield in the agriculture sector since these devices can be used to monitor soil acidity level, temperature, and other variables. ICT and IoT technology provide affordable technology solutions for efficient farming. It converts fixed costs into variable costs for farmers, thus making the techniques more affordable for a majority of small farmers. Its services are available on a subscription or pay-per-use basis in three broad categories, which are crucial across the agriculture value chain.

- ***Farm management solutions:*** Information sharing, analytics and precision farming tools
- ***Production assistance:*** On-site resources to aid production, such as equipment rentals
- ***Access to markets:*** Virtual platforms that connect farmers with suppliers of seeds, fertilisers and other agrochemicals, as well as consumers of their produce

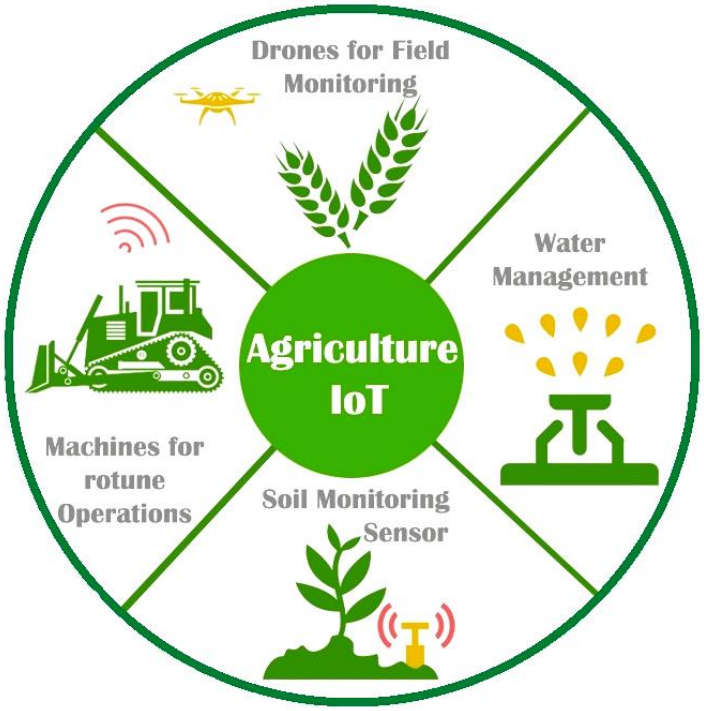


Figure 8.13 : IoT devices for Agriculture Monitering

8.7 National Policy on ICT in Agricultural Extension

National policy framework for agricultural extension (2000) stated that information technology revolution is unfolding and has very high visibility. Harnessing information technology for agricultural extension will receive high point in the policy agenda. Extensive use of modern information technology will be promoted for communication between

researchers, extension workers and their farmer clients to transfer technologies and information more cost effectively. Further, it emphasised IT application in marketing, wider use of electronic mass media for agricultural extension, farmer participation in IT programmes and support to the state government for using IT in agricultural extension, promoting IT based information kiosks and capacity building for use of IT. In recent year farmer's attitude to access to agricultural information has changed owing to the emergence of fast network of information and communication technology. Farmers can get the information regarding fertilizers, pesticides, crop patterns and weather forecasting and other information at zero affordable cost. Many of the organizations like government, private, co-operatives and public have also attempted to facilitate the information technology transfer in the agriculture sector. ICT is crucial in facilitating communication and access to information for agriculture and rural development.

National policy for farmers (2007) indicated that the potential of ICT would be harnessed by establishing gyan chaupels (Knowledge centres) in villages. Further, the Common Service Centres (CSCs) of the Department of Information Technology, Ministry of Communications and Information Technology, Government of India and those set up by the state governments and private initiative programmes will be evolved for inclusive broad-based development. Last mile and last person connectivity would be facilitated with the help of technologies such as broadband internet, community radio or internet-mobile phone synergies. National e-Governance Plan indicated that the typical services envisaged in Agriculture as a Mission Mode Projects (MMP) to provide information to the farmers on seeds, fertilizers, pesticides, Govt. Schemes, Soil recommendations, Crop management, Weather and marketing of agriculture produce. Several projects such as ASHA in Assam, KISSAN and e-Krishi in Kerala and Krishi Maratha Vahini in Karnataka have been initiated by the Department of Agriculture and Cooperation, Government of India

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CHAPTER - 09

Growth of Internet Retailing in India

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9.1 Rising of the Internet and Retailing

While the computing concepts that drive today's version of the Internet have been around since the 1960s, it wasn't until the 1990s that commercial Internet providers turned this connectivity into a type of luxury utility available to most middle-class households. The late 1990s and early 2000s saw web browsers and search engines become dominant operational interfaces, and a rapid period of development between 2005 and 2010 saw immense improvements in mobile access, social media spaces, technology advances and consumer adoption. In addition to mobile devices, developments in security made it possible for individuals to safely access banking, which was a milestone in and key part of the move from in-person commerce to online retail.

The Internet's capacity to provide information, facilitate two-way communication with customers, collect market research data, promote goods and services and ultimately to support the online ordering of merchandise, provides retailers with an extremely rich and flexible new channel. In so doing, the Internet gives retailers a mechanism for broadening target markets, improving customer communications, extending product lines, improving cost efficiency, enhancing customer relationships and delivering customised offers. By and large, consumers have responded enthusiastically to these innovations and on-line retail sales have grown significantly over the past fifteen years, and are predicted to continue rising into the future.

Serious attempts to trade on-line started to emerge in the mid 1990s when innovative, technically savvy companies responded to the opportunities and challenges posed by the Internet, to develop sophisticated web-sites to serve customers, in their homes. However, looking back, nearly two decades, to when this fast-paced electronic business environment

was just starting to evolve, its ultimate success must have looked far less certain. There were plenty of predictions, many of them highly optimistic, about the scale, scope and impact of this virtual business world,

9.1.1 Use of Internet Retailing

India's retail industry evolves, a growing number of value-conscious online shoppers are reshaping India's e-commerce landscape. Buyers from this cohort focus on finding affordable products that meet their needs of quality, durability, and trendiness. The retail industry in India contributes about 11 percent of the gross value added to overall GDP. However, the COVID-19 pandemic has thrown unprecedented challenges at the industry and put the brakes on growth. Finding fast pockets of growth will be crucial for the industry. It is expected that India's nominal GDP to show a moderate recovery, reaching $5.2 trillion by 2026 and enjoying a 10 percent growth trajectory this decade. India's share of private final consumption expenditure (PFCE) has been relatively high and stable at 60 percent of overall GDP and is expected to reach $3.2 trillion by 2026

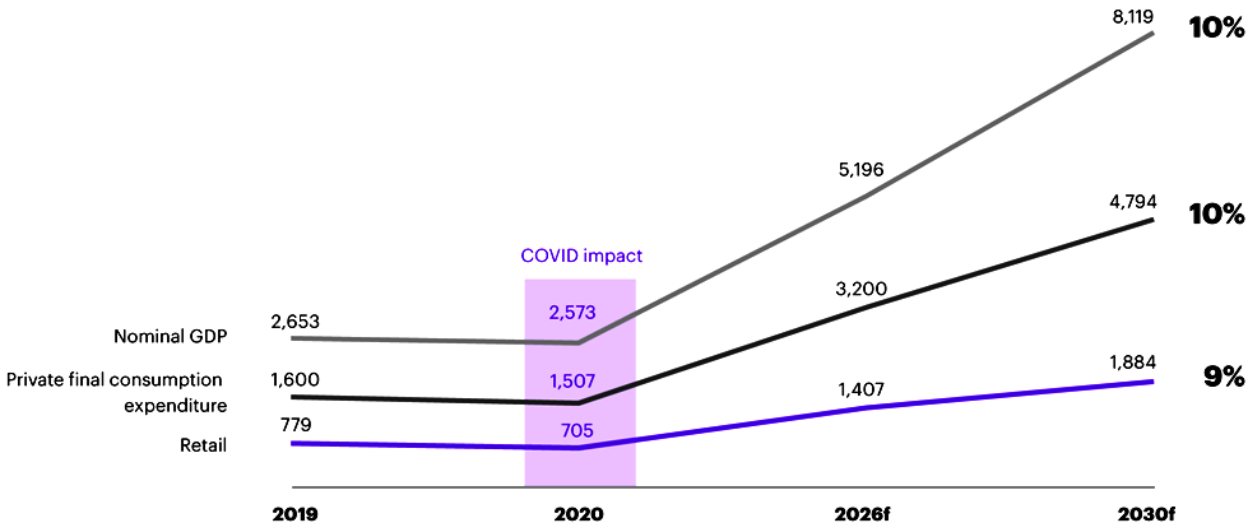

Figure 9.1 : Internet Retailing (Seven year CAGR : 2019-2026)

India's explosive growth in mobile Internet penetration from 320 million users in 2015 to 600 million users in 2019 has begun to impact the way consumers make buying decisions. Today, however, only 20 to 25 percent of people who have Internet access are using online platforms for commerce, and this has been heavily skewed toward metro and tier 1 consumers. However, active Internet use in rural towns (50 percent of value lifestyle

demand) and in tier 3 and tier 4 towns (about 25 percent of value lifestyle demand) is gradually growing and is expected to increase sharply over the next five years. Young people in these towns are getting hooked on digital content and social media. We expect the number of Internet users in India to surpass 1,100 million people by 2026 and a third of these will be active online buyers

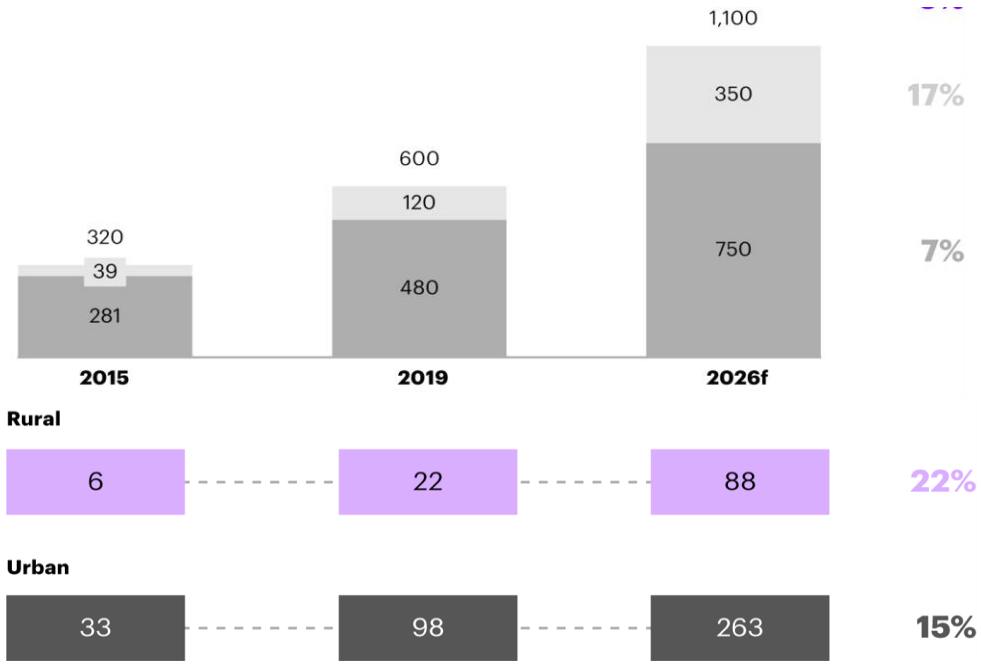

Figure 9.2: Internet users and active online shoppers (million), 7th Yr CAGR (2019-2026)

It's just a matter of time before massive growth unshackles India-2 consumers' online behaviors. Internet adoption and online buying for this segment is expected to accelerate, mainly led by young people over the next five years. (Gen Z will soon join Millennials as independent shoppers.) With the increase in overall household income and relatively stable levels of savings, this segment is expected to spend more on the value lifestyle segment. A lack of adequate brick-and-mortar options could lead them to rely more on e-commerce. It is expected that this group of consumers will account for 38 percent of value e-commerce demand by 2026 and more than 50 percent of value e-commerce demand by 2030, corresponding to 12 times growth by 2026 and more than 20 times by 2030.

According to Statista, the first quarter of 2021 showed between 13 and 14 percent of total American retail sales as online commerce. While some of this due to a jump in online program sales due to the COVID-19 pandemic, much of it reflects a nearly constant rise in

the percentage of online sales within all possible sales since at least 2010. This echoes technological growth as well. Most Americans in 2021 have access to either mobile devices or online banking. Many companies have some kind of electronic commerce marketing and sales options in order to compete in the modern marketplace.

9.2 Internet Affects Retailers

Consumers are always looking for the best deal, the best merchandise and the easiest way to access their favorite stores and products. Before the advent of the internet, retail brick and mortar stores were the only way to preview and buy goods, making it harder for consumers to buy what they really wanted and difficult for retailers to offer a wide variety of products. There was a limited amount of space for inventory, fewer stores and higher costs as retailers had to plan around their limited retail space. Once online shopping became mainstream, these shortcomings became a thing of retail past. Now customers and retailers are experiencing the many rewards from offering online outlets as a way to buy and sell consumer products. As the internet marketplace continues to grow, more and more consumers are purchasing items online and retailers are utilizing the online community to grow their businesses. In America alone, the online market is estimated to make between $150-200 billion annually and consumers are purchasing online at a higher rate than ever before. For retailers there are many advantages and disadvantages to opening online stores or moving their inventory to online shopping websites like Amazon.

9.3 The Evolution of the Internet and Its Impact on Retail Spaces

The internet has allowed retailers to connect with potential customers and express their brand in entirely new ways, and physical stores have become a part of their communication and sales strategy instead of being their only or primary way to reach consumers. Online and offline were once two very separate worlds. But with the rise of e-commerce and in particular mobile e-commerce, the distinction between online and offline is blurring rapidly. One of the internet's early effects was to foster a much greater proliferation of specialty retailers than ever before retailers with a unique point of view but not necessarily a need for a tremendous amount of floor space. The internet has allowed retailers to connect with potential customers and express their brand in entirely new ways, and physical stores have become a part of their communication and sales strategy instead of being their only or primary way to reach consumers. If we look at a successful mall today versus twenty years

ago, we will see a much stronger and more varied collection of tenants now than ever before, and shoppers have the internet and e-commerce to primarily thank for this more tailored collection. Meanwhile, omni-channel retailing has converged the online and offline shopping experiences. For retailers who practice this approach, prices are consistent in all formats, and consumers can choose between numerous options: shopping online with home delivery, shopping online and picking up at a store, shopping at a store and taking merchandise away, or shopping at a store and having it delivered to their home. With these internet-fueled changes gaining traction among retailers, developers of shopping centers are weighing the new choices that these technologies are bringing consumers, comparing them against brick & mortar's limitations, and beginning to respond with changes of their own. Just as many brands are now looking to trend-setting individuals that curate collections from a variety of sources, and then through social media connect with other consumers worldwide, shopping centers of all kinds are now also being curated in order to bring a special vibe or character to physical collections of stores. One of the biggest curation trends is to integrate strong national or international brands with stores or restaurants with a strong local vibe or presence, so that consumers feel that they have the best of everything available to them in one place.

9.4 Indian Online Shopping Industry Report

E-commerce has transformed the way business is done in India. The Indian E-commerce market is expected to grow to US$ 111.40 billion by 2025 from US$ 46.2 billion as of 2020. By 2030, it is expected to reach US$ 350 billion. By 2021, total e-commerce sales are expected to reach US$ 67-84 billion from the US$ 52.57 billion recorded in 2020. India's e-commerce market is expected to reach US$ 111 billion by 2024 and US$ 200 billion by 2026. Much of the growth for the industry has been triggered by an increase in internet and smartphone penetration. As of July 2021, the number of internet connections in India significantly increased to 784.59 million, driven by the 'Digital India' programme. Out of the total internet connections, ~61% connections were in urban areas, of which 97% connections were wireless.

9.4.1 Market Size

The Indian online grocery market is estimated to reach US$ 18.2 billion in 2024 from US $1.9 billion in 2019, expanding at a CAGR of 57%. India's e-commerce orders volume increased by

36% in the last quarter of 2020, with the personal care, beauty and wellness (PCB&W) segment being the largest beneficiary. India's consumer digital economy is expected to become a US$ 800 billion market by 2030, growing from US$ 537.5 billion in 2020, driven by strong adoption of online services such as e-commerce and edtech in the country. According to NASSCOM, despite COVID-19 challenges/disruptions, India's e-commerce market continues to grow at 5%, with expected sales of US$ 56.6 billion in 2021. Propelled by rising smartphone penetration, launch of 4G network and increasing consumer wealth, the Indian E-commerce market is expected to grow to US$ 200 billion by 2026 from US$ 38.5 billion in 2017. Online retail sales in India is expected to grow 31% to touch US$ 32.70 billion in 2018, led by Flipkart, Amazon India and Paytm Mall.

According to a report published by IAMAI and Kantar Research, India internet users are expected to reach 900 million by 2025 from ~622 million internet users in 2020, increasing at a CAGR of 45% until 2025. In October 2021, the expected e-commerce sales was US$ 4.6 billion, supported by the festival season in India. After China and the US, India had the third-largest online shopper base of 140 million in 2020. Indian consumers are increasingly adopting 5G smartphones even before roll out of the next-gen mobile broadband technology in the country. Smartphone shipments reached 150 million units and 5G smartphone shipments crossed 4 million in 2020, driven by high consumer demand post-lockdown.

9.5 Village Online Retailing

There is a need for the booming growth of online retailing. The rural Indian market ensures untapped potential to become the market leader for most e-commerce business enthusiasts and budding entrepreneurs. Since independence, nothing has happened in terms of boosting the rural distribution of commercial products within India's geographical boundaries. Therefore, the urgent need of the minute is to accelerate the expansion of commercial enterprises and e-commerce businesses in rural areas. India has emerged as one of the diverse countries worldwide, and more than 70% of India's population abides in villages or rural parts of India. The primary source of earning for people residing in rural areas is agro-based products as well as the regular crops produced by these village people only.

Since independence, the agro-based sector in India has gained momentum in terms of growth. It contributes half of the country's overall economy, and a significant bunch of population generates their livelihood from the agro-based sector. It's a daunting reality that

India hasn't witnessed the growth and rapid development in the agribusiness and agriculture sector as most of the people surviving in rural areas have got marginal land with them. After all, they are not much familiar with modern farming methods and techniques. In addition to this, they don't have adequate facilities in order to utilize it in full capacity. Exploring agricultural potential is a crucial factor that stimulates economic growth and can eventually lead to the development of an agro-based economy. The leading development powerhouse is the expansion of the agri-based sector, which is the dominant source of growth that took place in recent times.

9.6 Factors that Drive Growth in Online Shopping in India

According to reports published by International Monetary Fund (IMF) and Central Statistics Office (CSO), India is among the fastest-growing economies in the world. Among several factors, a conscious patronization of online commerce, and an emergence of retail as a dominant market segment have contributed to the unprecedented growth of eCommerce in India. The development of mobile-friendly websites has contributed a great deal to e-commerce growth in recent years. Going forward, the factors given below will be vital to succeeding in the value e-commerce space-

❖ The Internet's Influence on Retail

The use of Internet retailing has absolutely changed the face of shopping as the world knows it. Forty years ago, shopping was done entirely in physical locations. The only other ways to make purchases involved making calls on the telephone or submitting order forms through the postal service. While Amazon has technically been available since 1994, online retail shopping remained a small portion of overall retail, representing less than 10 percent as recently as 2010 in the United States.

❖ Availability and a Curated Assortment

A relevant and curated assortment is crucial in the value lifestyle segment, which is driven by differences in regional and local fashion perceptions and season cycles. As e-commerce platforms widen the reach to tier 2+ cities, where brick-and-mortar modern trade penetration is lower (17 percent compared with 31 percent for metro and tier 1 cities), retailers will need to provide convenient ways for consumers to discover, evaluate, and buy from a relevant, curated assortment that appeals to the quality and price points that these consumers want.

❖ **Relevant recommendations and reliable peer reviews**

Value lifestyle consumers expect e-commerce platforms to offer personalized shopping experiences in the form of relevant product recommendations. When evaluating products, they rely heavily on peer reviews and influencer opinions, and about 70 percent of them associate trust and credibility with e-commerce platforms because of relevant reviews and ratings.

❖ **Continuous consumer engagement**

With value lifestyle consumers being brand agnostic and experimental, loyalty could be strengthened by continuous consumer engagement programs as the value market moves from offline to online channels. Loyalty programs, online community building, and assisted and enhanced online product discovery are a few methods that market players are experimenting with.

❖ **Efficient supply chain and delivery**

To improve medium- to long-term earnings, value e-commerce players will need to continuously innovate and optimize their supply chain efficiency and delivery costs (forward and reverse supply chain) to balance smaller cart sizes. While the growing scale of tier 2+ operations will help optimize unit economics for the supply chain and delivery, continuous innovation will be essential to keep pilferage and delivery costs down. For non-metro locations, delivery costs are often more than 20 percent of the prevailing basket size of INR 300 to INR 500 per online order.

❖ **Supplementing online with offline**

A multichannel offering will increase penetration in product categories that have lower e-commerce penetration. Currently, certain product categories such as beauty products as well as home and living have low online penetration because of the ticket size and consumers' desire to try the product before buying it. Consequently, brick-and-mortar stores continue to dominate this space. Through investments in technology such as virtual reality-based online selling as well as select offline channel stores, e-commerce platforms can break this barrier to online initiation. In the long term, this can be a cost-efficient alternative for acquiring new customers compared with discount-driven customer acquisition and retention. E-commerce companies are better positioned than brick-and-mortar players to provide a true, integrated

omnichannel experience—from discovering and trying products to returns or repairs and conducive payment options.

❖ Social Media

The promise of free traffic has been very enticing to online merchants. Facebook boasts two billion active users worldwide, and a good percentage of online shoppers are among those users. Unsurprisingly, Facebook and other social media platforms have been launching pads for thousands of online businesses, and more and more retailers are implementing social marketing techniques to drive sales.

❖ Search Engine Optimization

SEO started with online media, but now e-tailers have recognized its immense value in driving free users to their sites. Unlike search engine marketing where each new customer comes at a marginal cost to the retailer, SEO promotes site traffic through natural search. Today, virtually all online merchants consider search engine optimization a website design priority.

❖ The Shopping Experience

One of the reasons why customers prefer to shop online than in brick-and-mortar stores is that the internet gives them the chance to weigh their options and get the best deals. They can quickly search for promotions and coupons and compare prices from several retailers. Moreover, the internet fulfills customer demand instantaneously, through immediate delivery. And, a buyer needn't worry about the availability items that are difficult to source locally. The sheer convenience of online shopping has contributed a lot to the growth of e-commerce.

❖ Faster Payments

Modern payment processing technologies have made completing purchases in online stores as smooth as ever. Thanks to high-risk merchant account providers, customers can conveniently buy products safely and instantaneously using their credit cards. Mobile-based payment gateways have particularly been on the rise and are poised to lead the global payment markets in the coming years, further fueling the growth of e-commerce. Value is an enduring concept in India. The journey of the value buyers toward online shopping has created a large and growing opportunity for India's e-commerce sector one that is poised to

grow 10 times in 10 years. When value consumers shift to online buying, they tend to replicate their offline values and buying behaviors. These are distinct from the online buying behaviors of affluent households in metro and tier one areas. All this represents a monumental opportunity to craft a well-defined value proposition based on affordable price and desirable quality. E-commerce companies are working to build efficient supply chain and delivery capabilities and trying to improve their engagement with their users to enhance familiarity and trust. They are also integrating technology to offer a personalized shopping experience. The companies that can mold their businesses around the distinctive needs of value consumers have the chance to lead the $40 billion value e-commerce opportunity in India.

9.7 Technology that Helps in Online Shopping

The e-commerce arena is young, but it's also thriving. The first forays of small online businesses in the dawn of the Internet era were fumbling, perhaps, but today's e-commerce businesses enjoy an unprecedented level of interconnectivity, which fosters dynamic and interactive relationships among businesses and provides nearly constant access to customers and potential customers.

- **Function :** The term "Online Shopping" is broad and somewhat interchangeable with "the digital economy" and "electronic business." On one hand, online shopping can refer to businesses that exist largely in the virtual world, for example, online retailers that handle customers without maintaining brick-and-mortar showrooms or the term can refer to businesses that incorporate e-commerce elements into their larger business models. For example, a graphic design firm might maintain offices for operations but market itself primarily via social media websites, which allow it to interact directly with its customers on a personal level.
- **Networking Technology :** Technologies like the Internet and personal computer are, of course, at the heart of the e-commerce revolution. But more recently, the explosive popularity of cell phones fueled heavy investment into boosting data-transfer speeds, allowing for faster, more-efficient and wireless business-to-business and business-to-customer connections. For example, consumers today can interact with e-commerce businesses from just about anywhere on Earth. Even if no cellular networks offer service to a region, satellite networks usually do.

- **Comparison-Shopping Technologies :** Comparison-shopping websites and applications give some e-Commerce businesses a significant advantage over physical retailers. Brick-and-mortar stores often must incorporate into their prices significant overhead costs, such as rent and utilities; many online retailers do not, allowing them to offer lower prices. Today, a consumer in the market for a given product can use a smartphone's camera in combination with a price-comparison application to scan a product's bar code. The application returns a wide variety of providers, allowing the customer to choose the lowest-priced option.
- **Effects :** Examples of the changing economic landscape abound; 39 percent of people who bought a book from a leading online retailer first viewed it in a brick-and-mortar bookstore and a bar-code-scanning phone application from that same online retailer threatens to lure customers from small brick-and-mortar businesses of all kinds,.

9.8 Future of E-retailing in India : Growth and Challenges

COVID-19 lockdown transformed consumer buying pattern in India, with the majority of consumers shifting to online platforms, even for their essentials and daily needs. Especially for e-commerce/ e-tailer players, the ecosystem has seen a paradigm shift. In India, the e-commerce industry is expected to grow from US$ 38.5 billion in 2017 to US$ 200 billion by 2026. India e-commerce industry is expected to become the second-largest in the world by 2034. On the other hand, the e-retail industry in India is primed to reach nearly 300 to 350 million shoppers in the next five years propelling online Gross Merchandise Value (GMV) to $100 to 120 billion by 2026. The $850 billion Indian retail market is the fourth largest market in the world. This magnanimous growth in the industry is fueled by the increasing base of first-time internet and smartphone users, an outcome of 'Digital India' campaign. As of August 2020, India had 760 million internet connections.

Along with this growing online community, another aspect that has been contributing to the growth of these sectors is the unorganized nature of the household essentials market. It has opened new avenues for e-retail/ e-tail/ e-commerce companies who not only understand the consumer psyche well but are able to curate quality products and services which are synced with the requirements of today's new-age consumers and bring them into the fold of the organized sector. As companies continue to innovate and onboard millions of shoppers, it is interesting to explore the major trends that will see prominence in this sector in 2021:

- **The Reality of Online Shopping will be Enhanced by Augmented Reality:** When it comes to online shopping augmented reality (AR) will become a major game-changer as it will significantly close the gap of ambiguity. It will help the customers visualize and decide the product that they want to buy. Before pressing the 'Buy Now' button they will be able to decide whether the furniture that they are buying would look good in their home or not. This will bring comparison for the shoppers to a whole new level and therefore help them to overcome the hurdle of not being able to see the product firsthand.
- **There will be a Significant Number of People Using Voice Search:** These days right from checking the weather to setting an alarm to buying products online people rely on voice assistants like Google Assistant and Amazon Alexa. Therefore, one thing that will that we'll all see in the future is that people will order groceries with a simple voice command as it will save a lot of time on browsing especially if it's a repeated order because one will not have to enter the brand, the address, the payment and shipping information again and again. Therefore, businesses that are looking to get into the ground floor for them there is a lot of untapped potentials.
- **Chatbots will Improve the Shopping Experience:** Chatbots in the coming time will serve the role of the brick-and-mortar, a greeter as well as a salesperson. They will not only be a huge help to the company as they will be able to communicate with hundreds of customers but also give them the feeling of personal attention and provide them with thoughtful recommendations based on their responses. According to a study, people actually prefer to converse with bots and other digital self-serving tools as they have a faster response time. They will drastically change the way people shop online and become one of the most important marketing tools.
- **Subscription Feature to Help Customers Coming Back:** For retailers, subscription plan have a number of advantages as they make it easier to predict fulfilment needs and they allow the customer to maintain and retain customers for a greater long-term value. Therefore, more and more companies will offer subscription service or monthly payment option for their purchases in the upcoming years to come.
- **Sustainability will Become one of the Main Focuses in the Coming Years:** One topic that is getting a lot of traction and hopefully is not a passing trend, is that now

more and more people are becoming aware of their role that their purchasing decisions have on the earth's limited resources. Therefore, now the brands have to find ways to weave into their product their marketing and fulfilment strategies. Brands that work on improving their operations by working on initiatives like having biodegradable packaging, going paperless, using recyclable supplies and working on behalf of the environment will undoubtedly have a robust impact on the buying decisions of the consumers. Overall, apart from the above, in 2021, the industry also expects increase in export revenues and increase in tax collection by exchequer. Further, these sectors have not only grown by themselves, but also is having a cascading effect on allied industries

e are on a strong growth trajectory, however there are still few challenges that the e-retailers in India face. Some of the key aspects which requires attention are:

- Some customers return much of the products that they buy online as there are a lot of first-time buyers and they are not sure about what to expect from the e-commerce websites, therefore, they fall prey to hard sell and when they finally receive the product, they regret their decision and end up returning the good. This in turn increases the cost as returns are extremely expensive for the e-commerce companies.
- Another challenge that companies face is that often the postal address is not correct and therefore it becomes a task for the company to deliver the product to the customer, affecting the delivery capacity of the delivery partner. One of the major issues that the industry faces is the issue is maintaining a robust supply chain

9.10 Conclusion

India's retail industry is set to witness a massive shift with its e-commerce sales expected to grow at a compound annual growth rate (CAGR) of 23% during 2020-25 to reach INR 9,328 Billion (US$119.0 Billion). Indian consumers preferred buying fresh groceries from local markets before the COVID-19 pandemic. However, due to the pandemic induced restrictions, online food & grocery sales grew by 76.7% in 2020 to reach INR 273.1 Billion (US$3.8 Billion) and are further expected to grow at a CAGR of 31.9% to reach INR1,088 Billion (US$13.9 Billion) in 2025. Indian retail sector is witnessing dynamic changes over the years. With a steady growth rate of 50- 60% online retail can make significant contribution to retail industry and economy of our country. In modern scenario, e-Retailing or online shopping has become part and parcel of the people in India. The new wave of consumerism coupled with

urbanization with paradigm shifts in the demographic and psychographic dynamics have driven consumers frequently to use retail website to search for product information and make a purchase of products. There are several things have been discussed to consider when e-retailing start. The e-commerce industry too needs to reinvent itself to match the changing customer expectations. Removal of supply chain bottlenecks, on-time last-mile delivery along with switching from the point-to-point model to the hub and spoke model would enhance the global competitiveness of domestic e-commerce players.

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CHAPTER - 10

Role and Potential of Digital Horticulture for Rural Development (Adoption & Enhancement)

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10.1 Introduction

Digital agriculture refers to the utilization of digital technology to integrate agricultural production from the farm to the consumer plate. These technologies can provide the platform for the agricultural industry with tools and information which helps in making more informed rectified decisions which ultimately improve productivity. The horticulture segment is considered as one of the most demanding and sustainable branch of agriculture all over the world. It covers pre and post harvest management of fruits and nuts, vegetables (including potatoes), ornamental and flowering plants, plantation crops, medicinal and aromatic plants, tuber crops, mushrooms, spices and condiments, edible bamboos, lawn management etc. It is an unshakable fact that horticulture is one of the best alternative option for improving the productivity of land, ensuring nutritional security for mankind, sustaining the livelihood of the farming community and boosting the economy of the country globally. To fulfil worldwide demands and challenges such as limited natural resources, food-security issues, higher consumer demands, innovative solutions in agriculture and its sub-sectors are required. Horticulture can play a major role in resolving all the raised issues.

In order to make horticulture innovation systems more efficient, it is essential to understand the mechanisms of innovation processes. Recently, changes in horticultural knowledge and technological systems have been reported worldwide. It is unrecognized and uncertain. In the majority of places, these knowledge or technological innovations are not practically implemented. Innovation activities in horticulture are strongly connected to other sectors, without their involvement it is not possible to implement innovation in the horticulture sector. Connectivity with other sectors it is very important these days to bring new

innovative change in the horticulture sector to uplift the current situation of farmers and environment.

For horticulture to flourish, advancement, innovation and investment need to boost along different chains within the sector. A consistent, high quantity and quality of production is desirable with the use of sustainable available natural resources, innovations and technologies that build horticultural production smarter and more proficient. One of the chief reason for loss in horticulture is due to the perishable nature of horticultural commodities which leads to heavy post harvest losses. Dropping post-harvest losses and enabling profitable trade in fresh produce requires good strategies, policies and practices for processing, aggregation, transport and storage of commodities.

Value addition involves transformation of raw produce to a new fresh product by improving its economical value which is driven by the consumer. Value addition brings uniqueness and novelty in products leading to a premium and stable price. Computer-based environmental sensing and control; high speed data interchange between critical production points; environmental sensors and equipment for monitoring plant status; advanced production techniques (hydroponics, CEA, ebb and flood, etc.). By using technology and optimizing growth conditions, we can use up to 95% less water than traditional farming, and, in some cases, can produce zero agricultural runoff. Vertical gardening approach can reduced the demand of land and enhance the utilization.

Digital agriculture is the new approaches which use digital technology to integrate agricultural production from the paddock to the consumer. These technologies can provide the agricultural industry with tools and information to make more informed decisions and improve productivity. By using technology and optimizing growth conditions, we can use up to 95% less water than traditional farming, and, in some cases, can produce zero agricultural runoff. Vertical gardening approach can reduced the demand of land and enhance the utilization. Digital agriculture is the use of digital technology to integrate agricultural production from the paddock to the consumer.

These technologies can provide the agricultural industry with tools and information to make more informed decisions and improve productivity. While demand is set to grow, farmers are facing the challenges of a changing climate:

- Increased temperatures

- Changes in rainfall patterns
- More frequent extreme weather events
- Reductions in water availability

In this environment, farmers must continue to innovate to maintain and improve productivity to meet demand. Digital technologies have the potential to provide farmers with the information and ability to meet these challenges and seize opportunities for growth. Consumers both at home and abroad are becoming more informed about the products they buy. They demand high quality and sustainably produced food and fibre and want to know more about where their products come from. Digital technologies can enable improved traceability of agricultural products, providing peace of mind for consumers and increased value for farmers.

10.1.1 Opportunities

The promise digital agriculture holds for farmers is to provide better information they can use to make more informed decisions to improve farm performance.

(a) Increasing Agriculture Production

The Australian Government's Accelerating precision agriculture to decision agriculture project found that digital agriculture could lift the gross value of agriculture production in Australia by $20.3 billion, or 25 per cent on 2014-15 levels.

(b) Regional Development

Digital agriculture can also support regional communities. Younger generations are keen to work with technology. Through increasing use of digital technology, agriculture can attract and retain younger generations to live and work in regional and rural communities. Digital agriculture provides an opportunity to create stronger regional and rural communities which are connected through the use of technology. This is a critical enabler for attracting and retaining local populations as well as start ups and other businesses.

A key technology underpinning digital agriculture is sensor technology and the Internet of Things (IoT). Remote sensors can be deployed on farms to collect data on variables such as temperature, rainfall, humidity, wind speed, livestock.

10.1.2 Key Barriers to Adoption

a) **Connectivity:** Appropriate connectivity is fundamental to digital agriculture with digitized farms needing widespread and reliable coverage.

b) **Digital literacy:** Many farmers have not had opportunities for practical learning and exposure to technology to identify the right technology options for their farm, or how to reliably use it.

c) **Cost and investment rational :** The value of digital agriculture has not been proven to farmers. Demonstration of return on investment is needed to boost adoption rates.

d) **Data sharing:** There is a lack of confidence in data privacy and security among farmers. Agreed data sharing protocols and governance arrangements are required to encourage the sharing of data across the value chain.

e) **Interoperability of data sets :** It is currently difficult for farmers to analyse data generated from multiple technologies. The ability to incorporate diverse datasets into a shared platform would allow farmers to gain greater insights and benefits from digital technologies tracking, and plant and animal health. This information can be relayed to farmers, to save time and cost from manual monitoring, provide greater insight into farm performance and improve farm decision making. The examples of Examples of Digital Agriculture are pportunities to lift productivity in the agricultural sector lie in new and emerging technologies such as:

I. robotics
II. new packaging material
III. biotechnology and digital and wireless technologies for data measurement
IV. weather monitoring
V. animal monitoring
VI. geospatial monitoring
VII. precision application of water and chemicals

a) Robotics

Robotics are being introduced to the dairy, poultry and beef farming industries. Applications include, autonomous feeding and milking, egg collection and sorting, autonomous cleaning.

b) Satellite imagery

In cropping, less waste and higher yields are being generated by equipment programmed for variable seeding rates and depths based on soil property and moisture data, derived from satellite imagery. Digital infra-red light and heat sensors combined with geographic

information system technology in drones are used measure field crop health to inform decisions about:

- irrigation
- pest management
- fertiliser applications
- harvesting

c) **Sensors and electronic identification :** Integrated digital animal health biometric sensors and electronic identification devices enable farmers to rapidly respond to cases of animal stress or disease, helping to increase livestock production and improve livestock health.

d) **The Digital Agriculture Investment Scheme :** The Digital Agriculture Investment Scheme (the Scheme) has been developed to assist farm businesses invest in digital technology to improve productivity, resilience, and the long-term viability of their farms.

10.2 Some Technological Innovation Techniques

10.2.1. Automation for Plant Monitoring

Crop scouting is a crucial step in pest and disease management. It allows the farmer to make timely decisions and take preventative measures. It saves time and money, allows trends to be identified, and predicts future threats and potential problems. Typical equipment for plant monitoring in a field or greenhouse includes: a magnifying glass, plastic bag for plant samples, clipboard, marker, and camera. Today, sticky traps and mobile apps can give a far more accurate picture of the pests and diseases in a crop; some apps even provide suggestions for possible solutions.

A recent innovation has been the development of digital scouting applications for mobile devices that provide a monitoring platform for the registration of diseases, and offer biological solutions for horticulture. A scanner may count the insects on sticky cards using accurate image recognition, for example. In this way, you can scan the sticky traps in a crop, while the dashboard on a desktop/laptop gives a direct schematic overview of the results. The data can then be collated with other measurements and a broad analysis can provide suggestions for biological solutions. The app can also have machine or deep learning capability which allows it to improve its predictive power over time.

10.2.2 Role of Robotics in Horticulture

A robot is an automatic tool that carry outs functions normally described by humans or simply it is a device in the form of human. This machine senses the environment, processes and responds to the sensor's information with the help of computer command. As labour is a major cost for horticulture production, approximately 50% cost of production is invested for fruit is only for hiring labour, intensive horticultural crops needs much more skilled labour as compare to broad scale agriculture. Therefore, there is a requirement for effective utilization of robots in the field of horticulture. Some of the types of robots used in horticulture are Demeter, robot for weed control, fruit picking robots, drones, forester robot, robot suit and vitirover solar robot etc. These robots are used in horticulture operations such as weeding, crop scouting, micro spraying, irrigation, selective harvesting, sorting and packing, parks and golf courts, polyhouses etc.

10.2.3 Use of Drones for Pest and Disease Identification and Management

Drones or Unmanned Aerial Vehicles (UAV) can identify diseases and pest 'hotspots' in standing crop and then accurately disperse beneficial insects from the air. Drones contains sensor and imaging capabilities which will play an increasingly significant role in identifying and reducing crop damage in the coming years. An innovative release mechanism designed for the aerial release of beneficial insects (biological organisms) can now be attached to a drone to disperse this biological solution exactly where it is needed most in the crop. Drones equipped with a scouting device can also be used to remotely locate and identify pests and diseases.

10.2.4 Alternatives to traditional growth in soil

Technology is revolutionizing the demand for natural resources such as water and land. So as per the requirement of the time and to get involve in sustainable, healthy farming people start adopting new techniques of farming such as Nutrient film technique, Hydroponics, Aeroponics and Aquaponics etc.

10.2.5 Symbiotic organisms and plant defenses:

Biocontrol : Nowadays research is focusing on how microorganisms can encourage plant growth and development and how it can be applied from the initiation of the cultivation. These can enrich the microbial composition of the environment around the roots of the

plants. Beneficial microbes can activate the defense mechanism of plants and help them grow stronger. When these kind of symbiotic organisms live near the root zone they also compete for space and nutrition with pathogens. Trichoderma for an example has a direct effect on the pathogen both via predation and through exuding antibiotic substances in the root zone. Microbial pesticides that are designed to work on foliage pests invade the destructive organism (often at larval stage) and use its tissue as food.

10.2.6 Precision agriculture for weed control, soil health and better yields

Precision agriculture can improves uniform application of herbicide by lowering the number of overlaps and skips and eliminating applications to non-cropping zone such as wetlands, waterways and odd-shaped boundaries. By adopting satellite-based auto-guidance (also called auto-steer) technology and using automatic boom section control can substantially decrease the herbicide misapplications without requiring the operator to turn boom sections on or off. Auto-guidance allows more precise control of the distance between two adjacent passes, significantly reducing steering-caused skips and overlaps, and does not require conventional markers. The automatic boom controller also can be programmed to spray areas that are not infested by weeds. There are various technology incorporated in field of horticulture .They are enlisted below

a) Horticulture Mechanization

- Harvester for mango, lime, sapota, guava, cassava & potato
- Cassava chipping machine
- Potato chipper
- Shell fired copra dryer
- Solar-cum-electric dryer
- Potato diggerPotato planter
- Graders (potato, onion etc.)
- Sorting, grading & wax treatment of citrus fruits
- Anola destoning machine
- Manual-cum-motorized spawn grain cleaner
- Electric operated grain boilerPotato planter
- Graders (potato, onion etc.)
- Sorting, grading & wax treatment of citrus fruits

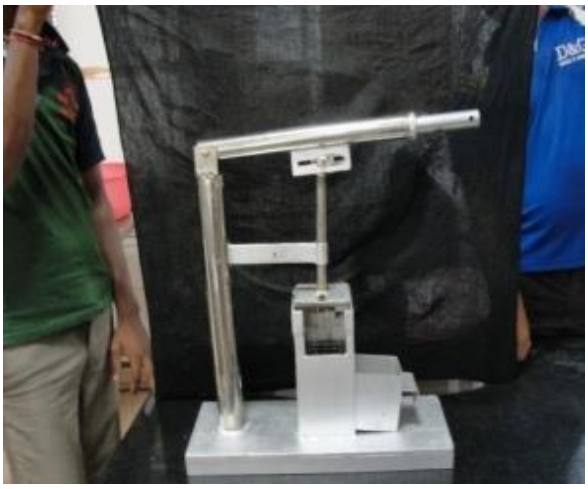
- Anola destining machine
- Manual-cum-motorized spawn grain cleaner
- Electric operated grain boiler

b) Some other innovation in field of horticulture in India

1. Power operated Onion Detopper

De-topping is one of the unique operations in the production of onion crop. It is tedious, time consuming and demanding huge labor to the extent of 12.5 man-hrs/t. This power operated onion de-topper aids in resolving this problem. It consists of a feed conveyor for feeding cured onion crop, de-topping rollers for shearing the leaves, separate collection chutes for the de-topped onion bulbs and leaves, power, main frame and power transmission system. The onion de-topper is powered by a three phases, 2 hp, 900 rpm electrical motor with necessary speed reduction gear box. The performance parameters of onion de-topper were found to be 98 % de-topping efficiency, 0.98 effectiveness of de-topping, 2 % damage and 300 kg/h capacity at 200rpm with the machinery costing about Rs.1,50,000/- per unit.

2. Portable Vegetable Dicing Tool



Vegetable chopping in bulk is time consuming and laborious process. Presently only kitchen dicing tools are available in market for dicing of vegetables. For cutting of vegetables in large amount, power operated vegetable slices wer available but this portable vegetable dicing tool is heavy duty, sturdy, long lasting and could be used for continuous dicing in bulk with no power consumption. The efficiency of cutting of the tool is about

97.23%. The cost saving in operation over conventional methods is approx 44% and time saving in operation over conventional method is 71%. It is suitable for street fast food vendors, marriage food caterers, restaurants, etc.

3. Shelf Life Extension of Peeled Garlic

Pre-treatments of garlic cloves in hot water and packaging in BOPP films or equivalent were given to maintain high humidity. The product has a minimum shelf life of 3 days at ambient temperature (approx. 28ºC), and up to 15-18 days at low temperature storage (8ºC). It reduces problems of sprouting, browning and softening. it do not involve any chemicals treatment.

4. Shelf Life Extension of Fresh-Cut French Beans

Pre-treatments of the freshly cut French beans (preferably varieties like Arka Sarath) with 100 ppm available chlorine in the form of sodium hypochlorite and packaging using suitable semi permeable films of different gas and vapour permeability can be used to obtain a equilibrium modified atmosphere of 12-14% oxygen and 5-6% carbon dioxide with a shelf life of 9-10 days.

5. Shelf Life Extension of Minimally Processed (Shredded) Cabbage

Freshly shredded cabbage are treated with calcium salts, surface dried and packed in 35 micron thick polypropylene films. This methodology provides specific protocols for preparation of minimally processed cabbage and enhancing its shelf life ranging from 19-21 days at 8 °C storage. This techinque uses low cost dip solutions, which are non- hazardous to health and available locally.

6. Shelf Life Extension of Fresh-Cut Cucumber

Browning of the cucumber rings is controlled by pre-treatments of the freshly-cut cucumber with ascorbic acid and packaging by using suitable semi-permeable cling film to obtain a shelf life of 6 days at 8 ^{o}C.

7. Osmotic Dehydration of Guava

For osmotic dehydration of guava fruits should be harvested at optimum stage of maturity (hard ripe stage), peeled. Seed containing pulp is scooped out, made into slices and dipped in sugar syrup (50-70 oBrix) containing citric acid, preservatives and other additives. Dried

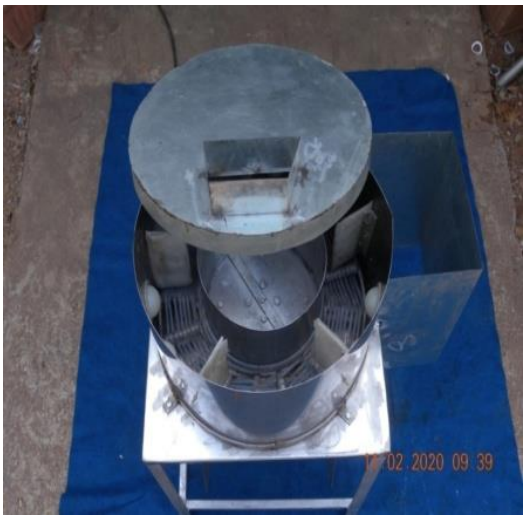
(moisture 15%) slices are packed in plastic punnets and can be stored at RT for six months to one year (pink fleshed). For 1 kg of dehydrated slices, it requires about 7-8 kg of ripe fruits and 2 kg of sugar.

8. Power Operated on Farm Onion Size Grader

An onion size grader for common onion with capacity of 2 ton/h is developed for easy grading. Grader consists of components namely i) feeding chute, ii) grading drum, iii) collection chute and iv) power transmission system. The grader contain three portions in which cushioned rods were mounted with a constant gap to grade onion less than 40 mm, 40.1 – 60 mm and 60.1 – 75 mm. The oversize onions greater than 75.1 mm size is collected at the other end of grading drum while, other three grades are collected through the cushioned outlets mounted lower the grading drum. One 2 hp geared motor with 50 rpm speed and four rollers mounted on the frame used to rotate the grading drum. The cost of grading is 10 times lower than manual grading.

9. Pomegranate Aril Extractor

A power operated pomegranate aril extractor was designed and developed. This machine consists of i) stationary drum fitted with silicon bouncers and battens, ii) rotating polar grid as fruit carrier, iii) lid with feeding chute, iv) outlet for peel, v) main frame and vi) Three phase 0.75 kW geared electric motor. Segments of pomegranate fruits are fed to the aril extracting unit through the feeding chute. The segments are carried by the fruit carrier plate. The arils are extracted by the silicon bouncers and battens. The pomegranate arils are passed through the fruit carrier plate and collected through the aril outlet. This machine has capacity of 80 kg/h with aril extracting efficiency of 93-95%. This machine is highly suitable for small scale pomegranate processing industries.



10. Solar Power Integrated Outdoor Mushroom Growing Unit

The present technology relates to the production of oyster mushroom by using low cost Solar Power Integrated Outdoor Mushroom Growing Unit which can be used at both rural and urban areas. currently majority of the growers are using permanent or semi permanent structures for the cultivation of mushrooms which were cost effective but this newly designed outside mobile chamber is low cost in contrast to the permanent building. It can even used during non favorable months of the year such as April and May. This mobile chamber gives a better environment for mushroom production due to its evaporative cooling principle. As the requirement of the space and capacity of the investment is less, maintenance is easy and less cost effective.

The overall dimension of the growing mushroom chamber is 1.35 x 0.93 x 1.69 m which is made up of 1" CPVC pipes and fittings. It is covered with nylon 40 meshes to prevent the entry of insects and to improve the aeration. It is further covered by locally available gunny bags by keeping them wet in order to maintain humidity inside the chamber. A 30W DC misting diaphragm pump with 10 nozzles of 0.1 mm size is used to produce more than 100 bar pressure in order to achieve very fine misting inside the chamber. It can be operated either by electric power or by solar power energy with 300 W panel, inverter, 12V storage battery and a timer. The entire growing chamber is fitted inside a mild steel frame of 1.08 x 1.48 x 1.8 (side height)x 2.2 (centre height) with mobile wheels for easy mobility and transport. The solar panels are mounted on the top of the roo of the frame and inverter and battery are placed and supported in the frame. A 30 litre water tank is fitted at the bottom side of the frame along with the misting pump. The average monthly mushroom yield from this structure is 25-28 kg.

❖ **The Essential Components of a Digital Horticulture Platform**

a) Standard data-loggers can only help read data from new sensors only. Additionally, the installation is non-trivial and typically requires a specialist. On the other hand, very few companies today can readily help extract data from the existing climate control system. For most growers, their data is trapped in a box. The jargon usually used in tech is

"vendor lock-in." Vendor and data lock-in is one of the main barriers that has prevented the greenhouse industry from catching up with the digital transformation trends.

b) Bridging Digital Horticulture and Autonomous Growing

In order to help indoor farms this digital horticulture and then move forward with autonomous growing, Koidra has designed a phased deployment roadmap technology. This roadmap utilizes three essential components of digital horticulture above, including data gateway, cloud-based data management, and significant business intelligence.

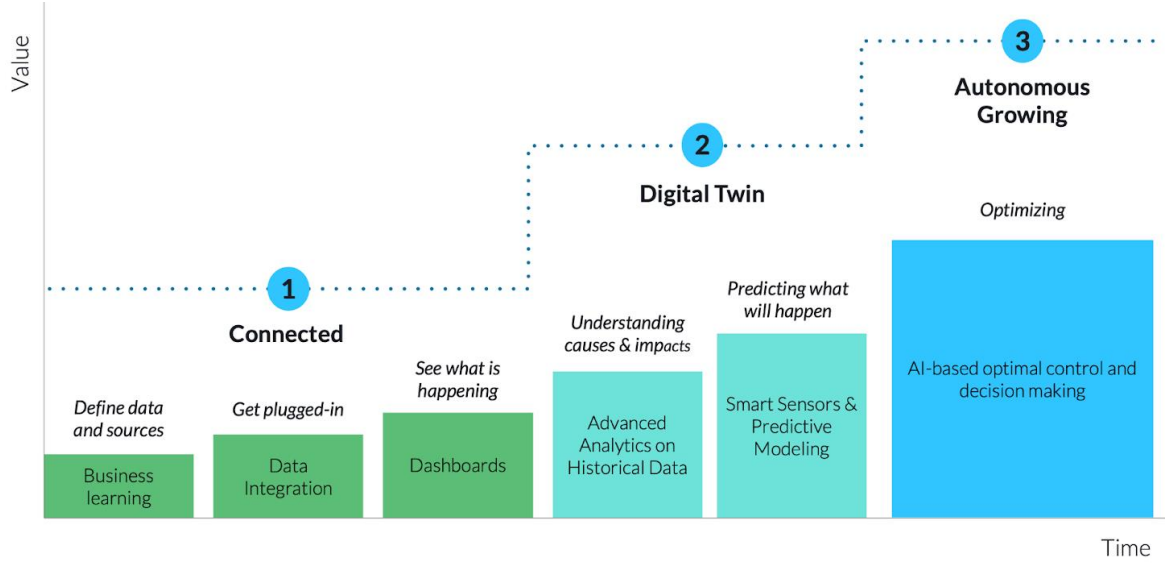


Figure 10.1 : Bridging Digital Horticulture

The strength of this implementation roadmap is to guarantee that each phase is a self-contained success, which must yield high ROI in itself while waiting for the next one to be assessed and installed.

c) Driving Yields and Sustainability

In the age of cloud computing, internet of things, and AI, digital horticulture is essential for farming businesses to stay data-driven, efficient, and resilient to meet the increasing food demands. This is especially relevant to the existing global food crisis that humanity is facing. Per the UN, 70% more food is needed by 2050 while resources (e.g., land, water, energy) are diminishing. Agriculture generally, and indoor farming specifically, is in need of a transformation by embracing the technology to move from intuition to a system of precision agriculture, from manual processes to automated solution.

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About the Author

Dr Jitendra Singh Bhadauria [Birth 1971] belongs with a farmer's family of Village - Jaitpur, Post office – Shah, District - Fatehpur, Uttar Pradesh, India. He graduated in Agriculure from CSJM University Kanpur and obtained his Master degree from University of Allahabad in field of Agricultural Extension where he was awarded as topper scholar in the university in his discipline. He did his Ph.D. degree from CCS University Meerut and Qualified National Eligibility Test (NET) four times, organized by Agricultural Scientist Recruitment Board (ASRB) New Delhi.

Dr Bhadauria got selection from Uttar Pradesh Higher Education Service Commission and joined as Assistant Professor & Head, in the department of Agricultural Extension in Janta Mahavidyalaya Ajitmal Auraiya (UP). He has worked as convener in various committees like coordinator of NAAC, coordinator of Rovers/ Rangers, coordinator of Agri-debate & Student fresher's meet. He performed the works as Assistant Superintendent in university exam, Estate officer, Chief Warden, Technical officer and also worked as member of women cell, salary committee, construction committee, placement cell, teacher selection committee etc. He was chief editor of college magzines "Surabhi and Krishi Digdarshika" and organised more than 50 Farmers Training Programme, 04 District Level Agricultural Fair, 06 Animal Exhibitions.

Dr Bhadauria has delivered 80 lectures in farmer's Goshthi where about 10000 farmers were benefited. He has organized technical farm visit & field demonstration for farmers of Bundelkhand region. He was active member of Agricultural Technology Management Agency (ATMA) governing Body in District Auraiya (UP). He was in lead role to establish in a Farmers Training Centre and Farmers Information Centre in campus of the college, with collaboration of department of agriculture, Govt. of Uttar Pradesh and worked as coordinator. He has more than 22 years experience in teaching, research, Extension & administration.

He is currently serving as Associate professor in Kulbhaskar Ashram Post Graduate College Allahabad (Prayagraj) which has high reputation in the field of agricultural education & research where he is actively engaged in teaching, research & extension. He has guided 13 students to complete the research thesis of M.Sc & M.Phil. He has participated & presented 90 research papers in various national and international seminar, workshop, symposia, & conferences. He has published 21 research papers in reputed Journals, 13 book/edited book/manuals with ISBN, 45 articles published in reputed magazines. He has participated in 16 Refresher course & Faculty Development Programmes (FDP). He also lifted 20 national/international awards for outstanding works of his field. He is having membership of various professional societies and has also member in board of study in many universities & commission where served as an expert, reviewer, paper setter, evaluator, observer, flying squad etc. in the field of agricultural education & administration.