**IMPACT OF INFORMATION TECHNOLOGY IN AGRICULTURE SECTOR**

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**CERTIFICATE OF ORIGINALITY**

The work embodied in this report entitled **“IMPACT OF INFORMATION TECHNOLOGY IN AGRICULTURE SECTOR’’** has been carried out by **Rohit Mehta** for the paper of **“History, Culture & Civilization ”**. We declare that the work and language included in this project report is free from any kind of plagiarism.

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**ABSTRACT**

**IMPACT OF INFORMATION IN AGRICULTURE SECTOR**

There are many ways in which Technology can be used to exchange the information rather effective communication like information kiosks which provide not only the basic services like email, helps in education, health services, Agriculture and Irrigation, online trading, community services etc., expert systems which helps in determining marketing alternatives and optimal strategies for producers, integrated crop management systems for different crops, Farm-level Intelligent Decision Support system developed to assist in determining optimal machinery management practices for farm-level system. Information technology helps to predicts the results related to the agriculture specially plant physiology. Leaf protein study is an important study which helps to solve protein deficiency and malnutrition. Present study deals with role of Technology in Agriculture.

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**HISTORY**

Agriculture plays a vital role in India‟s economy. The Indian agriculture system began as early as 9000 BC. During this period techniques were developed for the settled mode of production in agriculture and wheat, barley and jujube were the popular crops that were domesticated in the subcontinent by 9000 BC. The farm sector is contributing greatly to the productivity and stability of the country's economy due to which it has been believed that agricultural prosperity is fundamental to national prosperity. It accounts for about 18% of India‟s gross domestic product, provides employment to 58 per cent of her working population1 and the rural households depend on agriculture as their principal means of livelihood. Agriculture, along with fisheries and forestry, is one of the largest contributors to the Gross Domestic Product (GDP).2

🞆 **Green Revolution (1968) :** The goal of the **Green revolution** was to increase the efficiency of agricultural processes so that the productivity of the crops was increased and could help developing countries to face their growing population's needs.

🞆 **Ever-Green Revolution (1996) :** Dr.M.S.Swaminathan coined the term ‘**’Evergreen Revolution**” to highlight the **pathway of increasing production and productivity in a manner such that short and long term goals of food production are not mutually antagonistic**. The logic is to produce more from less, less land, less pesticide, less water and it must be an evergreen revolution to get sustainable agriculture.

🞆 **Blue Revolution (water, fish) : Blue Revolution** refers to the time of intense growth in the worldwide aquaculture industry from the mid-1960s to present. The aquaculture industry has been growing at an average rate of 9% a year. Worldwide aquaculture production has now reached 50 million tons, up from two million in 1950. **Blue**

**Revolution** also called as Neel Kranti Mission in **India** was launched in 1985-1900 during the 7th Five-Year Plan. The main objective is to develop, manage, and promote fisheries to double the farmers' income.

🞆 **White Revolution (Milk) :** Operation Flood is the program that led to "The White Revolution." It created a national milk grid linking **producers** throughout India to consumers in over 700 towns and cities and reducing seasonal and regional price variations while ensuring that **producers** get a major share of the profit by eliminating the middlemen.

🞆 **Yellow Revolution (flower, edible) :** The **revolution** launched in 1986- 1987 to increase the production of edible oil, especially mustard and sesame seeds to achieve self-reliance is known as the **Yellow Revolution**. ... **Yellow Revolution** targets nine oilseeds that are groundnut, mustard, soybean, safflower, sesame, sunflower, niger, linseed, and castor.

🞆 **Bio-Technology Revolution :** Modern biotechnology originated in the mid-1970s with new advances in genetics, immunology, and biochemistry. Biotechnology includes all

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techniques that use living organisms or substances from organisms to produce or alter a product, cause changes in plants or animals, or develop microorganisms for specific purposes.

🞆 **ICT Revolution:** “Information and Communication Technology” is big **revolution in Indian** farming community regarding the information about Agriculture production and market linkages between farmer and Mandis. It is great initiative which has been taken by the government of **India**.

**CULTURAL ASPECTS**

Agriculture needs effective utilization of technology to accelerate production and employability of individuals. The main purpose of this research paper is to understand, how to make effective use of technologies in the agricultural sector. There are numerous types of technologies that are made use of to enhance productivity. The main areas that have been taken into account are,

factors relating to adoption of technologies, types of technologies, technologies used in the agricultural sector, advanced agricultural technologies used in the present existence, areas of information technology and role of information technology in agricultural education management. For efficient growth and development of the agricultural sector, there is a need to familiarize with new technologies, like biotechnology, nanotechnology, high-tech protected cultivation and modern irrigation methods to accelerate production. These technologies, when utilized in an appropriate manner, would prove to be beneficial in improving productivity and profitability. Usage of technology would enhance in sustaining livelihood opportunities for the farmers.

Agriculture is regarded as a primary occupation of the individuals in rural areas. To feed the increasing population, it is essential to introduce modern and innovative techniques in the agricultural sector. New technologies are required to encourage the yield frontiers to an advanced stage, make use of the inputs resourcefully and diversify to a more sustainable and higher value cropping patterns. These are all knowledge intensive technologies that require both a strong research and extension system and skilled farmers.In addition, it also requires a strengthened interface,where emphasis is put on communal exchange of information, bringing advantages to all. Making use of resources in an effective manner is stated as the driving force behind the use of agricultural technologies. Several resource conservation technologies are, green manure, crop rotations etc. (New Technologies in Agricultural Development, 2014).

Improvement in the agricultural growth is an essential aspect for leading to overall growth and development of the country. The reason being, this sector sustains livelihood of 65 percent of the population. However, the contribution of agriculture towards Gross Domestic

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Product (GDP) is 14 percent. Several revolutions in agriculture have taken place to boost the sector. These include, Green Revolution, Evergreen Revolution, Blue Revolution, White Revolution, Yellow Revolution, Bio-technology Revolution, Information and Communications Technologies (ICT) Revolution. In order to increase productivity, it is essential to make use of technologies and what is required is the extension of these developed systems. Agriculture extension that has been combined with infrastructure is regarded as the key aspect towards agricultural growth. Involvement of the private sector would help in the absorption of technologies in this sector in a rapid way(New Technologies in Agricultural Development, 2014).

**Factors relating to Adoption of Technologies**

Factors relating to adoption of technologies have the potential to contribute to the sustainable farming systems. It is a comprehensive concept and is affected by the development, distribution and application at the farm level of the present and new biological, chemical and mechanical techniques, all of which are incorporated in farm capital andother inputs (Adoption of Technologies for Sustainable Farming Systems, 2001).

The adoption of technologies for sustainable farming systems and other agricultural practices is a challenging and a vigorous issue for the farmers, extension services, agriculture business and policy makers. Theagricultural sector needs to employ a wide range of changing technologies and farmpractices across many different farming systems and structures to meet a diversity ofchanging and varied demands from consumers and the public for food, fibre andother goods and services that are provided.Quite often ambiguous outcomes in termsof their effects on sustainability are depicted. The farmers and the agricultural labourers need to obtain adequate understanding of how to make use of technology to yield production.

Demand of the farmers have led to an increase in the adoption of technologies. Farmers have always looked to new technologies as a way to decrease the costs. In addition, higher incomes, enhanced knowledge and improved channels of communication are leading consumers to demand low cost food of high quality, gradually produced through organic methods in many countries, with more variety, consistency and year round availability. At the same time, consumers are increasingly making a demand that their food be produced,utilizing the techniques that conserve natural resources, limit environmental pressures and pay greater attention to rural practicality and animal welfare. The process of trade liberalisation is broadening the sources of

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supply and the degree of competition. The varying demands are reflected in policies and are strongly communicated to the farmers by the media, pressure groups, food retailers and processors.

The ways in which technologies are employed and made use of are different across countries. The different policies and concerns regarding the attainment of sustainable agriculture have resulted in the range of approaches and levels at which they are put into operation. Market signals, voluntary co-operative industry-led approaches guide the development, distribution and adoption of technologies in some countries. There have been large emphasis on the government intervention. Such government involvement ranges from anassisting to a mandatory role, and includes direct funding for research, payments for distribution and implementation, legal restraints, information and assistance. Moreover, the overall framework of agricultural policies and the level of support is a primary factor in defining which technologies are adopted at which locations at the farm level.

Research efforts, farmer’s education and training, advice and information are transferring towards balancing economic efficiency with environmental and social sustainability. The main focus of research and suggestions was to lead to an increase in profits, and productivity. Emphasis is put on achieving those objectives in a sustainable manner, which implies usage of technologies and changing farming practices. The technologies that are made use of in the agricultural sector are not always clear regarding profitability. Research has been conducted to determine the technology that would be beneficial to increasing production. These priorities include, biological pest control, biotechnology, information technology, bioremediation, precision farming, integrated and organic farming systems. Other issues, related to the educational and training systems, institutions and the role of public and private research efforts are crucial. Some sustainability issues are not addressed through technological aspects, but bybringing about changes in the types of agricultural production and its locations. There have been development of technologies in the global market and applied at the farm level, but have an impact on the sustainability beyond the farm. Both conventional and newer technologies, in particular related to biotechnology, information and precision

farmingtechniques, are universal industries. The distribution of those technologies is often within the national market, but their use is local. However, the effects on sustainability of farm level adoption spread beyond the farm. With more vertical integration, either through formal

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ownership structures or contractual relations along the whole food chain, resolutions on the adoption of technologies at the farm level often cannot be detached from the decisions taken elsewhere in the food chain. Adoption of technologies is multidisciplinary, taking into account the objectives related towards sustainable agriculture.

Adoption of technologies involves uncertainty and trade-offs. To generate sustainability, it is vital for the technologies to contribute to an economically efficient farm sector, financial practicality of the farmers and improving environmental performance. Technological developments are progressing at a fast pace and information on the costs and benefits of adopting technologies in agriculture is often inadequate. Thus, the selections on technology adoption are made in a climate of vaguenesswith a large element of trial and errorin its application, and the speediness and amount of adoption varies noticeably amongst farmers. This can have important implications as to the structure of the farms and the number of farmers that are able to securetheir financial positions in future.

Research and development efforts, the movement towards better education and training of farmers, the shift in the focus of guidance, rapid and inexpensive means of distributing and sharing information, accessibility of financial resources, pressures from consumers, non government organisations, the media and the public in general are contributing towards assisting in the implementation of sustainable farm technologies. Many policies, including those relating to agriculture, environment, and research and development, are making provision of a combination of incentives and disincentives to technology adoption. Environmental policies themselves progressively constrain the actions of the farmers, as the regulations, animal welfare standards and public health policies.

Often policies are providing conflicting signals which impede the acceptance of technology. Some agricultural strategies are positive towards the expansion of agriculture on environmentally fragile land, over-exploiting natural resources and not requiring farmers to take account of environmental spill-overs into other sectors. Many sustenance policies get capitalised into the value of land, inspiring a larger intensity of production and persuading the kinds of technologies employed. Some agricultural policies impose environmental restraints on farmers as a condition for getting support, but at levels higher than otherwise to reimburse for environmental damage, caused by other agricultural policies. In some countries, the environmental benefits provided by the farmers are remunerated, in others they are not.

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The farmers need to possess appropriate education and information to make use of technologies and farm practices. The farmers will make investments, when they are assured, they will generate profitability. Agricultural policies can change the prices that farmers are facing for inputs and outputs, which in turn will influence their decisions on investment and can lead to unmanageable farming practices. Where the environmental benefits from employing sustainable technologies are not expected to accumulate to farmers, but to people outside the agricultural sector, and where there are no markets for the benefits, levels of adoption could be sub-optimal from a societal perspective. Equally, where the costs of environmental effects of present farming activities are paid by other sectors, farmers will have no incentive to implementenvironmentally sustainable technologies.

The impact of farm technologies were assessed according to quite few, normally clear and measurable criteria, production, productivity, farm incomes, employment and trade. Assessing sustainability is more multifaceted, when environmental, social and ethical considerations aretaken into account. It is often not clear, what relationships are between the various components of sustainability, what should and can be measured, and how the results are to be understood, so that farmers, policy makers and other stakeholders can recognize with rational confidence which sustainable technologies work, which networks can best facilitate their distribution and implementation in different conditions, and at what costs and benefits.

**TECHNICAL ASPECTS**

**Role of IT in Agriculture**

In the context of agriculture, the potential of information technology (IT) can beassessed broadly under two heads: (a) as a tool for direct contribution to agricultural productivity and (b) as an indirect tool for empowering farmers to take informed and quality decisions which will have positive impact on the way agriculture and allied activities are conducted. Precision farming, popular in developed countries, extensively uses IT to make direct contribution to agricultural productivity. The techniques of remote sensing using satellite technologies, geographical information systems, agronomy and soil sciences are used to increase the agricultural output (Arundhathi and Subbiah, 2007). This approach is capital intensive and useful where large tracts of land are involved. Consequently it is more suitable for farming taken up on corporate lines. The indirect benefits of IT in empowering Indian farmer are significant and remain to be exploited. The Indian farmer urgently requires timely and reliable sources of information inputs for taking decisions. At present, the farmer depends on trickling down of decision inputs from conventional sources which are slow and unreliable. The changing environment faced by Indian

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farmers makes information not merely useful, but necessary to remain competitive (Jacobsen, 1987).

***Role of IT in Plant Physiology***

Plants react to their environment and to management interventions by adjusting physiological functions and structure. Functional–structural plant models (FSPM), combine the representation of threedimensional (3D) plant structure with selected physiological functions (Ansari and Iliyas, 2011) and (Iliyas and Ansari, 2013) An FSPM consists of an architectural part (plant structure) and a process part (plant functioning). The first deals with (i) the types of organs that are initiated and the way these are connected (topology), (ii) co-ordination in organ expansion dynamics, and (iii) geometrical variables (e.g. leaf angles, leaf curvature and Microbial Biotechnology). Green crop fractionation includes Deproteinised Leaf juice as a medium for fungal growth and for production of Protease (Josephin and Sayyed, 2005);

Study Of LPC and PCR Prepared From Radish (*Raphanus Sativus* Linn.) (Sayyed, 2011). Effect of additives on chlorophyll content in wet LPC prepared from juice of Medicago sativa Linn. (Sayyed, 2010). Changes in chlorophyll content of lucerne leaf juice during storage (Sayyed and Mungikar, 2003). Use of Deproteinised Leaf Juice (DPJ) in Microbial Biotechnology (Sayyed and Mungikar, 2005). Production of amylase of DPJ of four different plants (Sayyed, 2013). The process part may include any physiological or physical process that affects plant growth and development. Leaf protein is Good Source of Cyanocobalamine (B12), Ascorbic Acid (Vitamin C) and Folic Acid (Vitamin B9) (Iliyas and Badar,(2010) and also of Thiamine, Riboflavin and Pyridoxine from LPC of Some Plants (Iliyas and Badar, 2010) (e.g. photosynthesis, carbon allocation). This paper addresses the following questions: (i) how are FSPM constructed, and (ii) for what purposes are they useful? Static, architectural models are distinguished from dynamic models. Static models are useful in order to study the significance of plant structure, such as light distribution in the canopy, gas exchange, remote sensing, pesticide spraying studies, and interactions between plants and biotic agents. Dynamic models serve quantitatively to integrate knowledge on plant functions and morphology as modulated by environment. Applications are in the domain of plant sciences, (Shaikh and Sayyed, 2014) for example the study of plant plasticity as related to changes in the red:far red ratio of light in the canopy. With increasing availability of genetic information, FSPM will play a role in the assessment of the significance towards plant performance of variation in genetic traits across environments. In many crops, growers actively manipulate plant structure. FSPM is a promising tool to explore divergent management strategies.

***Introduction of Precision Agriculture through Informatization of Cultivation and Animal Breeding***

***Technology***

Networking of agricultural production facilities. Greenhouse environment measurement and control network. Target crops: cucumber, tomato. Real-time remote environmental monitoring and alarm system. Remote management of grain storage facility for high quality of agricultural products. Remote environmental monitoring system via the Internet. Real-time monitoring and analysis of temperature variation in the storage facility. Livestock individual information database and analysis system. Dairy cattle individual information database and individual recognition system. Establishment of agricultural facility automation. Yield forecasting system

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using agricultural facility environment database. Remote control and measurement system for agricultural facility. Greenhouse environment control system using mobile communication technology. Collection and distribution of crop growth stage information and pest information using GPS (Global Positioning System). Develop a device for portable information service. Automation of post harvest management for improving quality of agricultural products. Environment management system for horticultural products. Optimal environment maintenance and automatic

management system. Introduction of precision agriculture using newly developed high technology. Chloroplast analysis technique for diagnosis of plant nutrient status, optimal fertilization

recommendation. Productivity management of cultivation lot with GPS. Site-specific crop productivity management system

***IT and Indian Agriculture in The Future***

Technologically it is possible to develop suitable systems, as outlined in the previous sections, to cater to the information needs of Indian farmer. User friendly systems, particularly with content in local languages, can generate interest in the farmers and othersworking at the grassroots. It is possible to create dedicated networks or harness the power ofInternet to make these services is available to all parts of the country. The task of creating application packages and databases to cater to complete spectrum of Indian

agriculture is a giant task. The Long Term Agriculture Policy provides an exhaustive list of all the areas that are to be covered. This can be taken as a guiding list to evolve design and develop suitable systems catering to each of the specified areas. Our country has theadvantage of having a large number of

specialized institutions in place catering to variousaspects of Indian agriculture. These institutions can play a crucial role in designing the necessary applications and databases and services. This will facilitate modularization of the task, better control and help in achieving quick results. As it is, several institutions have already developed systems related to their area of specialization (Suresh, 2003)

For quick results, it may be useful to get the applications outsourced to software companies in India. This will facilitate quick deployment of applications and provide boost to the software industry in India. In order to avoid duplication of efforts, it may be useful to considerpromoting a coordinating agency which will have an advisory role to play in evolving standardinterface for users, broad design and monitoring of the progress (Attaluri *et al.,* 2011). In the post WTO regime, it is suggested that it is useful to focus more on some agricultural products to maintain an unquestionable competitive advantage for exports. This will call for urgent measures to introduce state of the art technologies such as remote sensing, geographical information systems (GIS), bio-engineering, etc. India has made rapid strides in satellite technologies. It is possible to effectively monitor agricultural performance using remote sensing and GIS applications (Singh, 2004). This will not only help in planning, advising and monitoring the status of the crops but also will help in responding quickly to crop stress conditions and natural calamities. Challenges of crop stress, soil problems, and natural disasters can be tackled effectively through these technologies. A beginning in precision farming can be encouraged in larger tracts of land in which export potential can be tilted in our country’s favor. While developing these systems it is necessary to appreciate that major audience that is targeted is not comfortable with computers.

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This places premium on user friendliness andit may be useful to consider touch screen technologies to improve user comfort levels. It is oftenobserved that touch screen kiosks, with their intuitive approach, provide a means for quicklearning and higher participation. It is also necessary to provide as much content as possible in local languages (Klepsc and Absher, 1997). Once the required application packages and databases are in place, a major challenge is with respect to dissemination of the information. The Krishi Vigyan Kendras, NGOs and cooperative societies may be used to set up information kiosks. Private enterprise is alsorequired to be drawn into these activities. These kiosks should provide information on other areasof interest such as education, information for which people have to travel distances such as thoserelated to the government, courts, etc. Facilities for email, raising queries to experts, uploadingdigital clips to draw the attention of experts to location specific problems can be envisaged.

The Indian farmer and those who are working for their welfare need to be e-powered to face the emerging scenario of complete or partial deregulation and reduction in government protection, opening up of agricultural markets, fluctuations in agricultural environment and to exploit possible opportunities for exports. The quality of rural life can also be improved by quality information inputs which provide better decision making abilities. IT canplay a major role in facilitating the process of transformation of rural India to meet thesechallenges and to remove the fast growing digital divides.By this study, the authors concludes that the Indian Govt. is being made a remarkable achievements especially in the area of agriculture by giving various facilities to the farmers in which the ICT services is one among which is helping the farmers to understand the modern cultivation methods, availability of agriculture inputs, irrigational sources, availability of pesticide and fertilizers for increasing the production and productivity of crops. The rapid changes in the field of information technology make it possible to develop and disseminate required electronic services to rural India. The existing bottlenecks in undertaking the tasks need to be addressed immediately. A national strategy needs to be drawn for spearheading IT penetration to rural India. A national coordinating agency with an advisoryrole can act as a catalyst in the process. No single institution or organization alone can succeed in the task of e-power in farmers and rural India. At the same time, scattered and half hearted attempts cannot be successful in meeting the objective. Industries with major stake in villages, such as fertilizer sector, should come together to provide the initial impetus. The success of any IT based service to rural India hinges on evolving a proper revenue model for the dissemination points. The ‘clicks and mortar’ rural kiosks should beintegrated with the ‘bricks and mortar’ industry to make them sustainable ventures by makingthem a business gateway to rural India. The information kiosks can draw revenue from the industry by providing and disseminating required services.Once these dissemination pointsprove to be economically viable, the IT revolution in rural India will require no crusaders.

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**CONCLUSION**

India as a whole like most of the developing world is rich in Indigenous genetic resources. The author observed that, the agriculture system got improved by the adaptation of new technology but adequate recognition of rights of farming community is lacking. Most of the rural populations are denied of their rights to land or property, water, labor and access to markets, education, information and new technologies. Traditional plant varieties and wild species are disappearing irreversibly due to the flaw of monoculture farming and use of new technologies like biotechnology and the process has resulted in the disappearance of farming know-how.

The significance of usage of technology in the agricultural sector has been recognized with the main purpose of meeting the food requirements of the individuals. India has made progress in agriculture, but productivity of the major agricultural and horticultural crops is low in comparison to other countries. There are still deficits in the usage of technology. Yields per hectare of food grains, fruits and vegetables within the country are far the below global averages. Even India’s most productive states are behind the global average. Similarly, the productivity of pulses and oilseeds can be increased, through giving consideration to the seeds, soil health, pest management, crop life-saving irrigation methods and post-harvest technology.

India’s population is expected to reach 1.5 billion by 2025, making food security most important social issue and food production will have to be increased substantially, to meet the requirements of anincreasing population. In rural areas, there are number of people who are residing in the conditions of poverty and backwardness. Agriculture is the primary occupation of the individuals in rural areas, hence, usage of technology and modern and innovative techniques and methods will prove to be advantageous for improvement in the living conditions of the individuals and in alleviating the problems of poverty. There are numerous technologies and individuals employed in the agricultural sector and farming practices need to possess knowledge and information, how to make best use of them.

∙ Significance of technology in agriculture is increasing day by day.

∙ With improved technologies, we can have a high crop yield.

∙ It can save time & money.

∙ It is very important to accelerate economy of the country.

∙ Both farmers & the consumers, can get the benefit of

∙ advanced technologies.

∙ In future, the agricultural field is likely to be more advanced .

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