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Impact of application tools & technologies in agriculture and horticulture sector in the present existence

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Abstract
Agriculture is a gigantic sector of the Indian economy as its share to gross domestic product (GDP) is almost 17-21 per cent. Over 55-60 per cent of the population adopts agriculture as main occupation. In spite of a large of Indian economy, agriculture is lagging behind many aspects and characterised by poor connectivity and disintegration of market, unreliable and delayed information to the farmers, small land holdings, non adoption or less adoption of improved technology and so on. It has become indispensable to explore various ways to keep our farmers updated about modern technologies and relevant information. The development and timely dissemination of better personalized technologies specific to different agro-climatic conditions, size of land holding, soil type, type of crops and related pests/diseases is the real issue to brazen out ahead for the agricultural scientists/experts. The timely availability of right information and its proper utilisation is indispensable for agriculture. Application tools & technologies based initiatives can be taken for propagation of information, transfer of technology, procurement of inputs and selling of outputs in a way so that farmers can be benefitted. The timely information and practical solutions of the agricultural problems helps the farmers to adopt good agricultural practices, make better choices of inputs and to plan the cultivation properly. It is the infrastructure and components that enable modern computing. Although there is no single, universal definition of Application tools & technologies, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, non-profit agencies, governments and criminal enterprises) to interact in the digital world..

Keywords: Application, tools, technologies, agriculture, farmers and communication

Introduction
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. The increased demand for food grains can be met only with sincere efforts in agricultural research and extension. In spite of a large of Indian economy, agriculture is lagging behind many aspects and characterised by poor connectivity and disintegration of market, unreliable and delayed information to the farmers, small land holdings, non adoption or less adoption of improved technology and so on. It has become indispensable to explore various ways to keep our farmers updated about modern technologies and relevant information to pace up them in current technological era. Information technology revolution is upcoming rapidly and more noticeable now. With the introduction of information and communication technologies, the traditional agriculture has been reformed, eventually contributing to the significant improvements in agricultural productivity and sustainability. Empowering farmers with the right information at the right time and place is essential for improving the efficiency and viability of small and marginal holdings. Large data and information can be effectively generated, stored, analyzed, disseminated and used to upgrade agriculture by inclusion of Information and Communication Technology. It may increase production many folds by providing prompt, reliable and locality based information services to the farmers (Ansari and Pandey, 2013)[2].Hence, Application tools & technologies in agriculture has become a budding field of research and application related to e-agriculture. Information and communication are always necessary in agriculture. Since people have started growing crops, raising livestock, and catching the fish, they have hunted information from one another. It can be construed broadly as "using electronic means for processing and disseminating information and thereby facilitating communication quickly and easily".

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Horticulture is one of the important allied fields of agriculture which contributes 33 per cent to the agricultural GDP (Anonymous, 2022). India stands on second position in both fruits and vegetable production with collective production of 311.71 mt of horticultural crops from an area of 25.3 million hectare. Export growth of fresh fruits and vegetables in term of value is 14% and of processed fruits and vegetables is 16.27%. The Indian population is expected to be 165 crores by 2050, which will be pulled the demand for fruits and vegetables from 97 million tones and 184 million tones to 170 million tones and 290 million tones respectively, which calls for advance technology-led development through Application tools & technologies (Shalendra and Sharma, 2011) [18]. The tools of e-extension & technologies are broadly categorized in five major forms based on operations and applications *viz.*
1. Web portals
2. Knowledge, Research, Information and Service Centers
3. Mobile Telephony and
4. Hybrid Projects
5. Mobile Appss

Framework of application tools & technologies in agriculture
On review of the above mentioned application tools & technologies initiatives, a common framework was found to disseminate agriculture related information. Farmers are facilitated by field workers who coordinate communication between agriculture experts and farmers. However, farmers can directly access to agricultural information system. Agriculture experts are usually contacted only when required genuinely and coordinators are able to answer the queries. Use of application tools & technologies in agriculture is mainly to disseminate agriculture related information to the farmers and to trade their produce in India. Information is broadcasting online or offline. Internet is a major media for information flow. The application tools & technologies initiatives in India are based chiefly to disseminate information. In the current framework of application tools & technologies, field coordinators as a link between farmers and information system are much needed due to many reasons. Sometimes, farmers are unable to browse information from the system or to comprehend the system. Field coordinators may send real farm situation to the experts or information system for their advices. This framework may be improved by including more advanced and high-tech approach in agriculture sector. Hence, another framework is proposed in the present paper.

Types of Technologies
Technologies are often classified into three types, these are software, hardware and org-ware. In understanding usage of technology in the agricultural and horticultural sector, it is important to understand the differences between technology types and their synergies and complementarities. Hardware refers to physical tools, software refers to the processes, skills, knowledge and information required in making use of technologies and org-ware means organizational technologies, it refers to the ownership and institutional arrangements pertaining to technologies. In the agricultural sector, hardware is exemplified by different crop varieties, software by farming practices or research by new farming varieties and org-ware, by the local institutions that assist in the utilization of agricultural adaptation technologies. Hard and soft technologies are often introduced in isolation, it has been

recognized that their simultaneous integration with org-ware is essential for achievement in adaptation (Adhiguru and Devi, 2012) [1].
An example of technological innovation that has made use of all three types of technologies can be found in the adoption of water harvesting technologies. In the early 1980s, the farmers have developed the methods of rehabilitating degraded land by improving soil quality. This is done by making small holes into the soil, into which farmers put small amounts of manure, plant sorghum and millet. This process is carried out in the traditional planting pits. In these pits, water and nutrients are concentrated in a precise way to where they are needed, and retain water for a long time. This helps the plants to better survive the dry spells and rehabilitate the degraded land. The seeds or the trees that are grown in the pits can be considered as hardware. The practices around creating the pits and improving the fertility of the soil can be considered as software, and the farmer to farmer field schools used to share the information with other farmers across the region is referred to as org- ware.
In order to lead to growth and development of the agricultural and horticultural sector, it is essential to make use of all three types of technologies. The area that is of concern is, hard technologies or hardware are often prioritized and made use of in isolation. When farmers are making use of these technologies, it is vital, they should be adequately aware and make use of them in an appropriate manner. There have been development of training centres, which make provision of knowledge and information to the farmers, how to make use of technologies to yield production and profitability (Chandrashekara, 2001) [4]. There is a need of encouragement and assistance within the countries in putting into practice, all three types of technologies in a mutually supportive manner. It needs to be ensured, sustainable and operative applications of technologies are made use of in the agricultural and horticultural sector.

Major components used for application tools & technologies initiatives in India
Major components which are used in our country for providing Application tools & technologies services to the farmers are web portals, mobile applications on android phone, SMS and voice messages on simple phones, information kiosks, videos and video conferencing with the experts. Agriculture experts are the key component in the whole process of disseminating information to the farmers. The application tools & technologies components may disseminate relevant, real, customized information to the farmers at appropriate time. Hence, Application tools & technologies provide a forum to reach masses easily and to make global and local information easily accessible to the stakeholders. Information dissemination in agriculture is cost effective, time saving and speedy application tools & technologies. Mobile telephony has emerged as the foremost choice of the majority of the urban and rural people. Mobile phones were found as the most widely accessed tool among the farmers for communication and for accessing agriculture-related information particularly for the marketing of produce. Researchers also reported that mobile phones were the most used application tools & technologies and highly accessible by the farmers. It was found in a comparative study that the livestock farmers of Uttar Pradesh, who were using application tools & technologies based information made significantly better decisions on various livestock practices as

compared to application tools & technologies non-users. Further, few studies reported that the application tools & technologies based initiatives helped farmers of Madhya Pradesh, Uttar Pradesh and Tamil Nadu of India, in reducing transaction cost while acquiring information and doing transactions in input and output markets.

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

In addition to the above, a few non-governmental organisations (NGOs) have initiated Application tools & technologies projects such as
- Tarahaat.com by Development Alternatives (Uttar Pradesh and Punjab)
- Mahitiz-samuha (Karnataka)
- VOICES – Madhyam Communications (Karnataka)
- Centre for Alternative Agriculture Media (CAAM)

Some exclusive agricultural portals are also available, such as
- Haritgyan.com
- Krishiworld.net
- TOEHOLDINDIA.com
- Agriwatch.com
- ITC"s Soyachoupal.com
- Acquachoupal.com
- Plantersnet.com, etc.

Proposed framework of application tools & technologies in Agriculture initiatives in India
Not only agricultural technologies but many other spheres will be covered in the proposed framework such as educational methodologies for improving educational status of rural youth, health aspect, e-governance and employment alerts. Farming community, unemployed, poor and undernourished population of rural India will be benefitted by the application tools & technologies. Presently, many application tools & technologies initiatives are based on spreading agricultural information among farmers, wherein agricultural experts are having key role (Manzar, 2004) [11]. Different types of media are used to disseminate information. Acceptance Model of Technology will be more useful and

acceptable if it includes few more features such as security, customers' trust regarding information about agriculture as well as better infrastructure for speedy accessibility. More advanced information technologies will be used in the proposed framework of application tools & technologies. Data mining involves the process of finding large quantity of previously unknown data, and their use in important decision making. There are many applications of data mining such as division of market and customers into segments, defining different prices for individual customer segments, creating customer profiles that the organization desires to acquire (Chhachhar et al., 2014) [5].

Simulation and modelling will be used in agricultural mechanization. Applying cognitive technologies in agriculture may help to choose best crop, best seed according to farm condition and farmer's need. Image processing will be used to determine particular disease or pest for the crop and to send its remedies directly to the farmers. Imaging techniques will also be useful in determining the vegetative index, land mapping of irrigated area, type of weed grown in the area etc. with greater accuracies (National Policy for Farmers,2007)[13].

Advanced Agricultural Technologies used in the Present Existence
Advanced agricultural technologies used in the present existence have been stated as follows:

Tractors on Autopilot
GPS tractors, combines, sprayers and more can precisely drive themselves through the field. After the user has told the on-board computer system how wide a pathway a given piece of equipment will cover, he will drive a short distance setting A &B points to make a line. Then the GPS system will have a track to follow and it extrapolates that line into parallel lines set separately by the width of the tool in use. These systems are capable of tracking curved lines as well. The tractor system is tied to the steering, assisting in keeping it on the track.

Swath Control and Variable Rate Technology
Building on GPS technology are swath control and variable rate technology (VRT). This is where direction really begins to show a return on investment. The farmer is controlling the size of the swath, a given piece of equipment takes through the field. This point is a visual representation of how swath control works. The savings come from utilizing fewer inputs like seeds, fertilizers, insecticides, pesticides, herbicides, etc. Since the size and shapes of fields are asymmetrical, one gets bound to overlap to some extent in every application (Santeramo et al., 2014) [29].

Tele matics
This technology is the equipment to talk to the farmers, equipment dealers and even other equipment. When one has to bring work to a halt, due to some problem within the equipment, with tele matics, the deal can access the on-board diagnostic system of the tractor. On the basis of the problem, equipment can be fixed right from the dealer. In this way, the farmers get back to work and their time of visiting the dealer also gets saved. Farmers are able to keep track of what field equipment is, fuel consumption, operating hours and much more. This technology also facilitates communication between tractors.

Livestock

Livestock has been contributing to generate productivity in the agricultural sector to a major extent. Therefore, it is important to take care of their needs. Collars developed for livestock are helping the individuals to keep track of their herds. Sensors in the collars send information to a rancher's smart phone giving the rancher a heads up on where his cattle might be, or maybe they are in some problem. The individuals are able to keep track of in what positions and situations their herds are. It is a kind of telematics for the herds. In rural areas, rearing of livestock is an important area and when farmers and agricultural labourers are engaged in their occupations, it is vital to keep track of livestock (Jabir, 2011) [10].

Mobile Technology

In the present existence, the use of mobile technology has become productive to a major extent. It is playing an imperative part in monitoring and controlling crop irrigation systems. With using proper equipment, a farmer is able to control his irrigation systems, instead of driving to each field. Mobiles and computers are facilitating these processes to a large extent. Moisture censures in the ground are able to communicate information about the levels of moisture present at certain depths in the soil. This leads to more precise control over the water and other inputs like usage of fertilizers, insecticides, pesticides that are applied by the irrigation pivots (Sahota, 2009) [24].

Crop Production

In order to improve crop production, there are number of areas that need to be taken into consideration. The farmers need to ensure the seeds, equipment and other materials that are made use of are of good quality, the tasks and functions are performed in an appropriate manner and they possess the required skills and abilities. They need to possess adequate knowledge and awareness to utilize technology in an appropriate manner. Weather modification is a technique that is necessary to create a suitable climate for crops. When perfect climate for crops is created, it leads to an increase in production. For this technology to succeed, it needs to be applied for a long term (Muhiwa, 2017) [22].

Field Documentation

The on-board monitors and the GPS systems, theability to document yields, application rates, and tillage practices is becoming manageable and more specific every year. In fact farmers are getting familiar with the concepts, where they have valuable and useful data, that it can be overwhelming to figure out how to implement it ineffectual manner. As harvesting equipment moves through the field, it calculates yield and moisture, as it goes tying it in with GPS co-ordinates. Upon completion, printing takes place of the map of the field and these are often referred to as heat maps (Mittal et al, 2010) [25].

Biotechnology

Biotech or genetic engineering (GE) is not a new technique, but it is an important tool with much more potential, yet to be unleashed. The form of GE most people have possibly heard of is herbicide resistance. The other would possibly be insect resistant traits. The use of insecticides and pesticides are made use of to control pests that may damage the crops. In most cases, biotechnology toxins are made use of that is the same toxin found in some organic pesticides. Insecticides and pesticides should be of good quality that crops can easily adapt to and help in augmenting productivity.

Weather Modification

Weather modification is the conscious modification or manipulation of the environment, with the main purpose of bringing about changes in the weather conditions. A recognized technology is known as cloud observation, to increase the chance of rain or snow to regulate the local water supply. In the distant future, with advancements, there will be climate engineering, intervening directly in the climate system. Two main technologies that are made use of to counter global warming are the removal of carbon dioxide and the regulation of sun radiation (Karanasios, 2011) [27].

Smart Materials

The term smart materials is used as a collective term for materials that are able to change their shape through the external influences, including pressure, temperature, humidity, acidity, and electric and magnetic fields. Examples of these materials include, piezoelectric materials or piezo-crystals, shape memory metal, electric and magnetic-rheological (ER/MR) liquids, conductive polymers, colour changing materials and light emitting materials. The use of smart materials have proven to be beneficial, they are used to clean up hazardous materials, add up functional performance, have an impact on packaging and so forth (Paul,2004) [15].

Renewable Energy

The importance of renewable energy such as, wind and solar energy primarily is made use of in the production of electrical energy. The change to this form of energy, requires the electrification of a large number of activities that are now based on fossil fuels, such as, heating and rapid movements. Bio fuels may be part of the solution, if there will not be any fossil fuels left. Renewable energy is an important aspect within the agricultural sector. There are numerous reasons, why agricultural sector has played an important role in the production of renewable energy.

Bio-refinery and Bio fuels

Bio-refinery aims to process the biomass in an efficient manner for the optimal use of components and minimal waste. The complete utilization of bio mass, does not require additional agricultural land. It is also possible to exchange the residual flows of biomass between different value chains to attain optimum use and to avoid competition between food, fodder and fuels. Bio fuels is a co-operative term for fuels made from biomass. It is normally not possible to replace petrol or diesel with bio fuel without adapting the engine. The first generation bio fuels leads to a reduction in carbon dioxide emissions by 50% and the second generation by 90%.

Application tool & technologies Initiatives for Agricultural in India

Approximately 45 per cent application tools & technologies projects of the whole world have been implemented in India and also maximum number of information kiosks has been employed in rural India (Bahl, 2008) [3]. Nevertheless, it was found that majority of the application tools & technologies projects in agriculture were put into action in socio-economically developed states of South and North India, while deprived states are not benefitted by application tools &

technologies initiatives (Meera, 2004) [12]. Some of the e-Agriculture initiatives in India are indicated below.

Agris net
It is a comprehensive web portal to broadcast relevant information to farmers, which was initiated and funded by the Ministry of Agriculture, Government of India. The AGRISNET serves farming community by disseminating information and providing services through use of Information & Communication Technology (application tools & technologies). It has following goals:
- Providing information to the farmers on quality of the inputs and its availability
- disseminating information of various government schemes and recommending fertilizers after soil testing
- Providing information on latest technologies for increasing productivity in agriculture.

Digital green
Digital Green is an international organization, which works with the participatory approach by engaging rural community to improve their livelihood using digital platform. Interactive and self-explanatory videos are prepared for farmers by progressive farmers with the assistance of experts. These videos are shown to the farmers at individual level or in groups. The videos are prepared concentrating the requirements and welfare of the rural masses (Hui, 2006) [21].

E Sagu
The e Sagu system was developed in 2004. E Sagu provides customized solution to the farmers' problems and advise them from sowing to harvesting. Farmers send their farm condition in the form of digital photographs and videos, which were analyzed by the agricultural scientists and experts. After that, they suggest the right things to do to the farmers even small and marginal farmers are also getting advantage by this. The expert advice is conveyed to the concerned farmer within short time. The queries of illiterate farmers are dealt with the help of educated coordinators at village level. The farm situation or problem is communicated to the agricultural experts and they transmit accurate information to the farmers.

Warana
The Warana "Wired Village" project was instigated in 1998 by the Prime Minister's Office Information Technology (IT) Task Force with the objective of providing agricultural information and services to farmers for increasing productivity. The information is transmitted to the farmers in local language about prices of agricultural outputs, employment schemes from the government of Maharashtra and educational opportunities. The information is disseminated through information kiosks with the help of operators, who are the main linkage between the farmers and the agricultural connoisseurs.

IKSL
IFFCO KISAN SANCHAR LTD (IFFCO Kisan) was started in 2012. It delivers relevant information and custom-made solutions to the concerned farmers through voice messages on mobile phones. The farmers can also communicate directly to the agricultural experts on explicit themes via 'phone-in' programmes.

Agmarknet
Agricultural Marketing Information Network (AGMARKNET) was commenced in March, 2000 by Ministry of Agriculture, Government of India with the aim of empowering decision-making ability of the farmers regarding selling of their produce. This portal was developed to pace up the agricultural marketing system through broadcasting information about influx of agricultural commodities in the market and their prices to producers, consumers, traders, and policy makers transparently and quickly.

Digital Mandi
Digital Mandi is an electronic trading platform for facilitating farmers and traders to sell and procure agricultural produce beyond the geographical and temporal limitations effortlessly. Various financial institutions also participate in online trading of agricultural output to remove cash crisis (Kuenkel, and Aitken, 2015) [28].

eArik
The eArik project was initiated in 2007 and it aims to disseminate climate smart agricultural practices and to achieve food security. It is an integrated platform to enhance the accessibility of agricultural information and technology in north-eastern India. It delivers agricultural specialist advice on crop cultivation, crop management and marketing. Farmers can also obtain information direct from the portal but field workers help farmers to access application tools & technologies based information or to consult with other agricultural experts.

Akashganaga
This application tools & technologies project makes possible the milk collection, fat testing, and payment timely and user friendly manner. It augments the income generation of dairy farmers through incorporation of advanced technology.

aAQUA (Almost All Questions Answered)
aAQUA is a multilingual online system that facilitates farmers by advising them, solving their problems and answering their questions related to agriculture. Farmers have to register on aAQUA platform online or telephonically. After that, they can post their queries on the portal, for which they get answers shortly.

Fisher Friend Mobile Advisory KCC
The Fisher Friend Programme (FFP) of M S Swaminathan Research Foundation was launched in 2009 to protect fisher folk from occupational hazards and to empower their livelihoods. The relevant information on wave height, wind speed and director, potential fishing zones, relevant news, government schemes and market price is provided to fishermen in local language. The FFP covers marginalized coastal communities in Tamil Nadu, Puducherry, Andhra Pradesh, Kerala, and Odisha, and is operational in English, Tamil, Telugu, Malayalam, Odiya languages.

Reuters Market Light
Reuters Market Light (RML) was initiated in October, 2007 to deliver customized information to the registered farmers via mobile-SMS. It disseminates information in eight local languages in 13 states.

SMS Portal/mKisan Portal

This portal is designed aiming to serve farmers in three ways:
1. To disseminate information about diverse agricultural activities,
2. To provide seasonal advisories and
3. To provide various services directly to farmers through SMSs in their local languages.

The SMS Portal endows with a platform for amalgamation of service delivery under different sectors viz. Agriculture, Horticulture, Animal Husbandry and Fisheries.

Mahindara Kisan Mitra

This portal provides information to the farmers on price of commodities, weather forecast, crop advisories, loans, insurance, cold storage and warehouses along with success stories of progressive farmers.

Kisan Call Centers (KCCs)

KCCs were commenced on January 21, 2004 by the Department of Agricultural and Co-operation with the main intend of endowing extension services to the farming community in the local languages. The queries of farmers are tackled by agricultural graduates on help line, toll free number in their local language. The agricultural scientists also visit the field in person to get an idea about complex agricultural problems to resolve them.

Village Knowledge Centers (VKCs)

Village knowledge centers of MS Swaminathan research foundation, initiated in 1998 in Pondichery as a gateway of technical information related to agricultural inputs, price of outputs, crop rotation, use of fertilizers and pesticides. Information is disseminated through public address system.

Agronxt

AgroNxt platform is multitasking platform for the farmers where farmers can get inputs, agriculture advice, weather condition etc. AgroNxt thrives to contribute to agriculture industry by delivering farmers usable, reliable and timely information that maximizes farm profitability. It assists upholding the agricultural productivity and sustainability.

Mobile Telephony
Lifelines India
 Connectivity is created by a revolutionary combination of telephony and internet. This reaches 2305,000 farmers across three Indian states.

IKSL (Kisan Sanchar Limited)

IFFCO This offers voice mail from the local language. To date, 95,000 voice mail and 81,000 question & answer archives have been provided with 5,000 input from farmers. IKSL Value Added Services and IKSL registration are available to 10 active Lakh farmers as IKSL retailers cross 4 million and 40,000 cooperative societies.

RML (Reuters Market Light)

RML was launched in 2009 to provide micro information specifically for the farming society. To dates, 1,400 markets and 2800 weather sites from 15,000 villages in 13 Indian states, it currently covers more than 440 crops and varieties. Using RML, timely and customized data and individual farmers have earned substantial returns on their investment achieving up to INR 200,000 ($4000) in additional profits, and savings of almost INR 400,000 ($8000).

Mobile apps
Herbal Kisan
Detailed information about techniques of cultivation of medicinal and aromatic plants for peasants, students, drug manufacturers.

Fertilizer Calculator
To measure the exact amount of fertilizers per unit area needed on the basis of recommendations or soil tests.

Pesticides/Fungicides/Herbicides Calculator
To manage insects / diseases / weeds and minimize excess use, apply exact quantities of pesticides / fungicides / herbicides with different active ingredients.

Plant Population Calculator
Calculate the exact amount of seeds needed for your field crops or plates for your horticultural crops unit area.

Seed Rate Calculator
Based on test weight and seed germination, measure the exact quantity of seeds needed.

Seed Blending Calculator
To avoid wasting marginal seed lots according to Karl Pearson square rule, measure mixing of marginal lots with high germination lots. It could also be used as a tool for wine blending.

SMS Broadcast Service by KVK
It offers regular weather alerts, disease forecasts and market information, updates to the KVK's Farmers Clubs and SHG network on critical training and other services. It is an effective tool to spread development and empower farmers to face the challenge of a future free market.

ASHA
Asha's network of services is remarkable in its own way as it provides services across five different farming sectors. These include forestry, horticulture, livestock husbandry, fishing and sericulture; all under one umbrella. It provides appropriate and need-based agricultural data to North-East India's Assam state farmers. (www.assamagribusiness.nic.in).

ITC-e-Choupal
 It is an initiative under India Tobacco Company, an Indian conglomerate, which connect directly with the rural farmers through this web for buying the products related to the agricultural and aquaculture sector such as wheat, prawns, coffee and soybean. It addresses the challenges related with the agriculture of India such as weak infrastructure, fragmented land holdings, involvement of the middleman, etc. This deploys access to internet devices in rural part of India to provide farmers with up-to-date marketing and agricultural information (Gonnet and Soungari, 2017) [26].

KIRAN
Knowledge Innovation Repository of Agriculture/Horticulture in the North East is an instrument of the user platform to harness the power NE area through dynamic collaboration and convergence among the various stakeholders. It acts as a

catalyst through convergence and networking to strengthen the existing institutional capacity. Provide consulting in engineering and development along with dynamics and kinetics design info. This promotes sustainable horticultural development programs in the area and supports future research and extension plan formulation.

Expert System on Seed Spices
It provides full information about the country's Seed Spice Production Management. It includes Cumin, Fenugreek, Coriander, Fennel, Nigella, Dill, Ajowain seed spices. It advises farmers ' interest on the basis of location, cultural and climatic conditions and other characteristics. It suggests farm practices like field planning, fertilizer application, scheduling irrigation, etc (RML, 2010) [17].

Institutional Initiatives in e-Extension and application tools & technologies
Krishi Gyan Portal
It provides information on cultivation aspects of all crops grown in Chhattisgarh state through Indira Gandhi Krishi Vishwavidyala Raipur Ex e Krishi Rojgar, cPhulwari and IGKV News

Crop Doctor
It is an android based mobile application for the farmers in national level. The objective of this application is to wider reach and easy accessibility of crop information and service among farmers. It disseminates disease, insect, nutrient deficiency of crop information to the farmers as required (N Jamaluddin, 2013) [14]. Crop Doctor Covered almost all major crops of Paddy, vegetables, pulses and Oil seed. App is Unicode supported and bilingual i. e., both in English and Hindi as well. Farmers can query the information with image from various nutrient deficiencies, disease, insects affected for obtaining the solution as required. In new version of crop doctor farmer can also access the information related Agriculture Schemes, Farm Implements, Agriculture News etc. Crop doctor app is developed by IGKV-NIC Raipur, Chhattisgarh (igkvcropdoctor) [7].

e-Krishi Pathshala
The e-Krishi Pathshala App is an initiative by the Hon'ble Vice-Chancellor to improve the mobile experience of all IGKV students, Staffs and faculty. The following feature for students and faculty are available Student corner:
1. Student Profile
2. Registration
3. Result
4. Latest Notification
5. Fee Receipt

IGKV (the "Company") is engaged in providing cloud-based software for generating registration card src, and other receipts and documents for education through their Website www.igkv.ac.in and Android based Applications. The term "Software" wherever referred to, shall mean and include the Company's Website and Android Applications, collectively and/or separately, wherever the context so requires (ekrishiPathshala) [6].

e-Krishi Panchang
This mobile app has been launched by Hon'ble Governor of Chhattisgarh to to make farming more accessible through digital revolution for the farmers. NIC Raipur developed this app in collaboration with Indira Gandhi Agricultural University for undertaking various farming related operations, along with offering a list of holidays, muhurat, festivals and other key information of Hindi Panchang (krishipanchang) [8].

e-HAAT
e-HAAT is the online Agri-Market where farmers can buy/sell or advertise fruits, vegetables, agriculture produce or any agriculture machinery, Tools or Tractors etc (Mahila-e-haat) [9].

Application tools & technologies for horticultural crops
We are working in the field of Agro Electronics since 25 years in India with major thrust on application tools & technologies for Irrigation by the brand, Nano Ganesh- A Mobile Based Remote Control System for the Water Pumps. During the course of this big time phase, we came across so many challenges faced by the farmers and they sought for the solutions. In all the ways, application tools & technologies was a major solution to solve their problems. We are listing and describing briefly how application tools & technologies is a magic for the farmers in sustainable crops. It may be interesting and entertaining to while reading few of unbelievable application tools & technologies applications we have provided or witnessed in Indian horticulture (Kumar and Rajbhar, 2019) [30]. There are so many application tools & technologies applications but the following are few universal ones to throw light on the various possibilities.

1. **Electronics Fencing for Banana Plot**: The electronics fencing of galvanized wire along the perimeter of the farm of two to three acres having a banana plantation. This fencing has been charged by a high voltage such that it is not fatalistic but will provide a mild shock to animals or even a human being. The alert can be sent to the farmers mobile phone if there is some attempt of a breach.
2. **Wild Animals Voice Sound Generator for areca nut and banana:** In Goa State of India and forest prone agriculture area, there is a big challenge of monkeys spoiling the areca Nut and banana plantation. They easily cross the electronics fencing but are scared due to the loud sound of tiger or elephant. But, these monkeys are so clever that once they get acquainted with the cycles of the sounds, they are not scared. So, there are few application tools & technologies in India creating different sounds at different time cycles so as to confuse the monkeys. The sounds are generated by an amplifier powered by solar and controlled by Remote control (USAID, 2010) [19].
3. **Weather forecast alert for Grapes and Mangos:** In India, many times there is a weather change in the month of December when the flowers of mangos have just started blossoming. Sometimes in the month of March, the winds destroy the flowers of mango tending to huge loss of yield. Similarly, showers in December cause a big loss to budding grapes. A few years ago, it was a direct loss, but now with the help of weather forecast from different application tools & technologies service providers, farmers can proactively work on the coverings, emergency medicines, temporary curtains etc. to avoid the loss of flowers and buds.
4. **Moisture Sensors in Drip Irrigation connected to Cloud (IOT):** The yield depends on the adequate

quantity of water to the horticulture products. Accurate sensor controlled water through drip and sprinklers irrigation has helped a lot to Grape Growers in Nasik Region of Maharashtra State in India. The amount of water can be measured per day in winter, summer as well as sensed by the moisture sensors. There is a huge saving of water, soil minerals due to controlled irrigation. Wireless monitoring and controlling of irrigation has been achieved with the help of Nano Ganesh system.

5. **Application tools & technologies in Green House:** Many rose gardens and strawberry farms in Western Maharashtra are developed in the controlled weather created by Green House Net sheds. Temperature, irrigation, humidity, light radiations etc. are controlled with the help of different equipment with application tools & technologies intelligence. Everything is well monitored from the urban office of the grower (Rebekka and Saravanan, 2015) [16].

6. **Sorting of fruits (Color, size, smell, weight etc.):** It is a tedious job to sort out the fruits as per color, size, quality and smell. I have seen some photo sensing machines as well as size sorters run with a full automation which gives fruits sorted out in different boxes along with an output in the form of digital data sent to the computer terminal.

7. **Sequential timers for irrigation:** If there are say 10 plots to be irrigated with less capacity of the water pump, every plot is irrigated one by one with solenoid valve control and water sensors. This data is put to the cloud for analytics.

8. **Electrical Motor Pump Burning Prevention Device with alert:** There is a big loss of yield if a water pump is burnt due to erratic power in the peak period. There is a vast network of the pumps and electrical cables in the agriculture farms burning of motors tend to not only headache of irrigation but expenses in repairs, logistics and time loss. In India, almost 80% water pumps are equipped with application tools & technologies protection devices to prevent burning of motors and sending alerts on mobile phones if any voltage or current crosses the limits (Kameswari,2011) [23].

9. **Communication with the overseas market for Grapes:** Farmers have now efficiently established the communication with the domestic and overseas market. They can take a wise decision in the group or an individual about driving the products to the logistics network.

10. **Health-care of plants and soil:** Though it is still in incubating stage, application tools & technologies for the health care of plants and soil mineral contents are being on the way to farmers. In sugarcane belt in India, the contents of the particular soil minerals have been totally diluted tending to loss of fertility of the soil due to overwatering. Application tools & technologies role is important to diagnose the minerals in the plants as well as soil material. Different electronics sensors along with chemical processes are most useful in deciding the fertilizers input to the soil.

11. **Postharvest Management and storage:** Temperature data of refrigeration and storage along with data of control and monitoring during the logistics as well as static storage is a vital sector of tools & technologies applications. There are so many localized application tools & technologies innovations used in the agriculture

that few of them seem to be really scalable across the globe (Somogyi *et al.*, 1996) [20].

Conclusion
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 an increasing 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.

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