Application of Cloud Computing in Agricultural Development of Rural India

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Abstract : The real India lives in its villages and smaller towns and therein lies the future of India. Rural India has been ignored for more than 60 years and the cloud technology will bring the change that is required to bridge the divide rural India and Urban India ,and will improve the Indian rural economy . The principal source of income of India is agriculture. So the development of the ICT is basically focused on the Indian agriculture sector.
Cloud computing is a general term used to describe a new class of network based computing that take place over the internet. These platform hide the complexity and details of underlying infrastructure from users and applications by providing very simple graphical interface.
Latest technological development has through a dramatic change in every field and agriculture is no exception to it. Cloud computing technology impacted positively on agriculture field and related services they provide for users.

INTRODUCTION:

In recent years, new ICT technologies are being implemented in every sector of the developing nations. The principal source of income of these countries is agriculture. So, the development of the ICT is basically focussed on the Indian agricultural sector. But the significant investment cost for ICT infrastructure and maintenance is one of the primary drawbacks. As a result, the main concern for the information technicians is to find a faster, reliable, efficient, user-friendly but at the same time cheaper ICT tool for this field. Our paper is thus concerned with the concept of implementing such an ICT tool which will maintain a huge but well customized, updated and secured data base with instantaneous connectivity but with reasonable investment cost. That new application domain of ICT is Cloud Computing. It allows users to make use of services such as real-time computation, data access, and storage to end-users without the need to know the physical location and configuration of the system that delivers the services. Hence, if we need to improve the economic condition of these developing nations then the only way to do that is to improve the Indian agricultural sectors of them. One possible way by which this can be achieved is the successful implementation of the new ICT tool, Cloud Computing.

OBJECTIVE:

The objective of this paper is thus concerned with the concept of cloud Computing, its effective implementation and how effectively it can contribute as an ICT tool to play a vital role in developing the Indian agricultural sectors in the developing countries.

WHAT IS CLOUD COMPUTING:

Cloud computing is a tool to make IT related services available in a simplified manner hiding the complexities of those services, without really knowing and getting involved in the technicalities of how and what to do in providing the needed services. The term "*cloud computing*" is given to this approach because the users do not really need to know who is providing those services and users consider that the services are rendered by the cloud – an unknown to them. The charm of cloud computing is that the services may be availed whenever and wherever needed. It also reduces the cost of availing those services drastically. At the same time, it offers involvement of very less manpower and maintenance of those services. It also makes users free from certain concerns such as buying software, maintaining them up to date, maintenance of data etc. All these issues would be taken care of by Cloud providers. Cloud computing offers various models based on user requirement.

Three of the most basic cloud computing models are:

- *Software as a Service (SAAS):* It includes the ICT working environment tools such as software, web applications etc., without buying/downloading and installing in specific machines. Another characteristic of this model is that the users are charged for whatever has to be used for a specific duration, against the traditional way of buying and paying for the full application.
- *Platform as a Service (PAAS):* It provides clients the computing platform for designing and developing specific applications with minimum redundancy. It also takes care of hosting of those applications without concerning about hardware and data storage requirement. It also guarantees the availability of most recent platforms and their security.
- *Infrastructure as a Service (IAAS):* This model usually includes tangible as well as intangible components used in availing ICT services, such as virtual computers, traffic monitoring and re-directing, basic network components etc. This is the most prominent benefit of cloud computing as the organizations invest the most in establishing infrastructure.
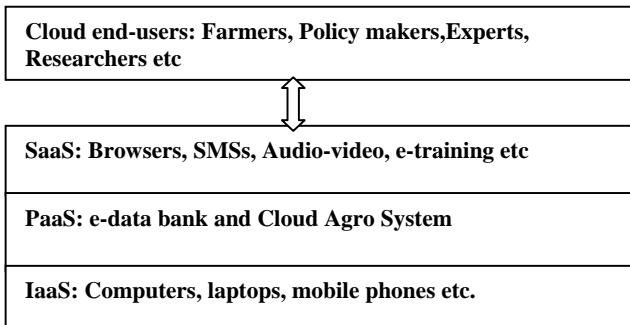
Cloud end-users: Farmers, Policy makers,Experts, Researchers etc

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SaaS: Browsers, SMSs, Audio-video, e-training etc
PaaS: e-data bank and Cloud Agro System
IaaS: Computers, laptops, mobile phones etc.

Figure-1: Basic Cloud computing structure

Although cloud computing looks so promising, it has few concerns mostly to do with the compatibility of cyber related laws between different countries. It is specifically applicable if the service provider and the client are from different countries. A study was conducted among 24 ICT leading countries covering 80% of the world's Information and Communication Technology (ICT) by Business Software Alliance (BSA 2012) [2], and has come up with 7-point policy blueprints to tackle this issue. Another big challenge is the security of data and the services. This can be taken care of by carefully selecting the service provider and opting for the most reputed ones in this field.

GLOBAL SCENARIO OF CLOUD COMPUTING

Cloud computing services were first offered by Amazon Web services in 2006. Initially most of the potential clients were not convinced to accept this shift. But gradually it has started picking up the market looking at its primary features viz.storage space, efficiency, easy accessibility, strong security, longevity, cheaper investment and maintenance, interoperability, ease of shifting base, quality support etc.

The current global market scenario is that cloud computing is considered to be one of the most revolutionary tools that has already started showing its impact in the international market. It is treated as a paradigm shift of ICT services from the traditional way of owning the whole organization based ICT set-up to hiring the set-up and delegating the most difficult parts of it to the service providers.

Key Facts

Some of the key facts that are the most prominent ones in uplifting cloud computing globally, according to a study done by one of the cloud service providers, "*cloudhypermartket.com*", are given below:

➤ Almost 70% of the users believe that it has simplified the IT management process.
➤ 72% users have experienced improved end-user assistance.
➤ 63% users consider that it has brought down the IT performance challenges.
➤ 73% users believe that it has reduced the cost of infrastructure.
➤ According to 74% of the users, it has alleviated internal resource pressures.

KEY FEATURES

Among all the cloud computing features, following three features were found to be the core of uplifting cloud computing to the current level, according to a survey[1] done among 250 organizations.
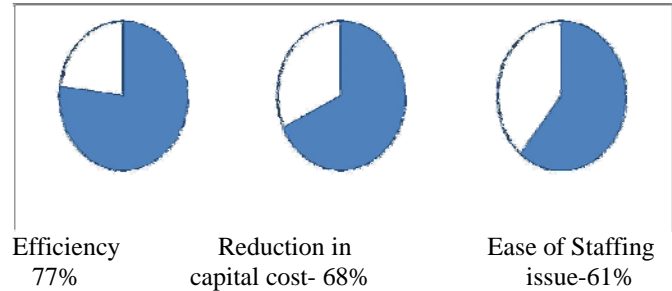

| Efficiency 77% | Reduction in capital cost- 68% | Ease of Staffing issue-61% |

Figure -2: Key features of cloud computing [1]

The diagram below depicts the current trend of value of cloud computing services worldwide. It clearly indicates the shift of traditional ICT trends towards cloud computing.
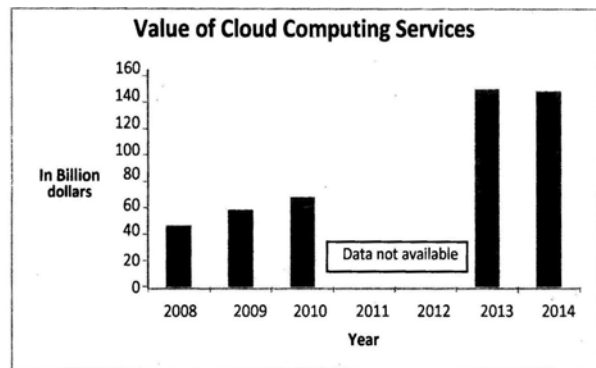

Figure-3: Value of cloud computing services [1]

IMPLEMENTATION IN AGRICULTURAL SECTOR:

Although cloud computing is picking up the global market covering almost all the prime sectors, there is nothing much done in Indian agricultural sector. Few countries like China, Japan, some parts of Africa, USA etc. have started implementing cloud computing in agro sector in recent past, but it is still in dormant state. It is considered to be a new shift in developing countries.

A recent study conducted by Business Software Alliance (BSA) [2] shows the readiness of few Asian countries in adopting cloud computing in Agro sector. Japan as the leading country, the study placed Korea at eighth, Singapore at tenth, Malaysia at the thirteenth and India holding the Nineteenth position.

An encouraging factor and a key finding in this study is that the economy does not play a vital role in terms of readiness of implementation of cloud computing in any sector.

Bhutan is comparatively new nation to ICT. A fully digital national telecommunication network interconnecting all the twenty Dzongkhags (districts) of Bhutan was established in 1998. Mobile services were introduced in 2003. But Bhutan did not take time in realizing the importance of ICT and started using ICT in different key sectors, viz. all the ministries and prime organizations (government, corporate and private). Though the Indian agricultural sector contributes around 20% of the country's GDP and around 65% of the total population is employed by this sector, Bhutan has not done much in applying ICT in this field. One reason for not being able to do much in implementing ICT in Indian agricultural sector could be the geographical topography of the nation. Looking at its geography, Bhutan needs a huge investment in establishing a sophisticated ICT infrastructure. Another prime concern is the connectivity from one end of the nation to another with a centralized control, which demands a competitive pool of maintenance crew. Also it makes the centralized setup very complicated and difficult to manage, and Bhutan lacks competent man power.

ENHANCEMENT OF AGRICULTURAL SECTOR OF BHUTAN

This paper introduces the concept of implementation of cloud computing in the Indian agricultural sector. It intends to introduce cloud computing model with two core parts in it. The first part is to monitor and fulfill user requirements with a user-friendly and faster approach, and the other one to store all relevant data in a centralized location – cloud.

1. **Cloud Agro System**: This part of the system can be used to monitor the overall functionalities of the system and render the needed services. The system will have online service facilities available to all the users, from any part of the country and at any time. In order to render these services, the Agro system may have the following services:

- *Demand-supply*: It can provide an up to date picture of the current demand and supply information of agro products in different parts of the country. It helps the farmers in deciding on selection of the crops. It also provides room to go for a comparative analysis of the demand and supply chain.
- *Communication*: Literacy rate of Bhutan is little more than 48% (with urban Bhutan at 71% and rural at 40%), according to a survey done by the Centre of Bhutan Studies (CBS) in 2010. It indicates that majority of urban population are illiterate, who are in general farmers. Therefore, the system will provide services in their national language, which is dzongkha. The system will also have audio-visual facilities to disseminate information.
- *Communication Devices:* The mobile services in Bhutan have covered almost all parts of the country and almost each family has access to it. Though majority of the local farmers have never heard of ICT, they are used to with mobile services. Thus, the

system incorporates mobile services and helps the farmers in acquiring information from e-data bank from anywhere, at any time, through mobile phones.
- *e-Knowledge sharing*: The system also keeps provision to have online communication with the experts/consultants and attend online training programs using the Community Service Centres (CSC) as the local information bases. The system is not restricted to only local information; cloud agro is a global ICT approach. The system, therefore, will collect and disseminate agriculture related global information to the local farmers. This will be specifically useful if they need information that is not locally available or not yet implemented in Bhutan. Also farmers can be made aware of recent agro related concepts, such as "Organic cultivation" using this global ICT approach.
- *Conducting Research*: It will help the national and international researchers to extract Indian agricultural data directly from the e-data bank and analyse them in order to contribute to the Indian agricultural sector of the nation. The research findings will be kept in the e-data bank and will be available to all its stake holders.

2. **e-Data Bank**: It is a central data bank and it can be used to store all the agriculture related information in a centralized cloud, which will be available to all the users at anytime, anywhere. The main concept behind having an e-data bank is to disseminate vital information to the local farmers in decision making. In order to do so, the e-data bank includes the following databases:

- ✓ *Crop related information*: It captures information related to all the crops grown in recent past in different regions. This will help the local farmers of different parts of the nation in crop related decision making.
- ✓ *Weather information*: It stores the region specific weather information and also the weather forecast for a specific duration. It will benefit the farmers in decision making related to selection of crops.
- ✓ *Soil Information*: Soil information also plays a vital role in crop related decision making. So, this section provides information on nature of soil of different parts of the country. It can also provide the trend of soil in past and will help in forecasting the future trend of soil.
- ✓ *Growth progress monitoring*: It monitors and captures data on crop growth in different regions on a regular interval. This will be specifically useful in comparing the crop growth region wise and also comparing it with past data will bring a clearer picture.
- ✓ *Farmers Data*: It captures the region wise farmer related data, to monitor and study the involvement of local farmers in Indianagricultural sector. It will

help the policy makers in designing Indianagricultural policies. This will also help in identifying the core Indianagricultural areas, so that the policy makers can take decision on encouraging and promoting agriculture. This may help in overcoming problems such as unemployment and rural-urban migration.

✓ **Expert Consultation**: It provides solutions to common problems that farmers frequently experience. It can also have a provision to post unattended problems seeking for solutions from the experts. It will also have a bundle of frequently asked questions (FAQs) and their answers to make the response reach the farmers faster.

THE SUGGESTED CLOUD AGRO SYSTEM

Based on the above stated system, the paper suggests the following model to implement cloud computing as an ICT tool in Indianagricultural sector of Bhutan:

Bhutan Cloud Agro System (CAS) Model
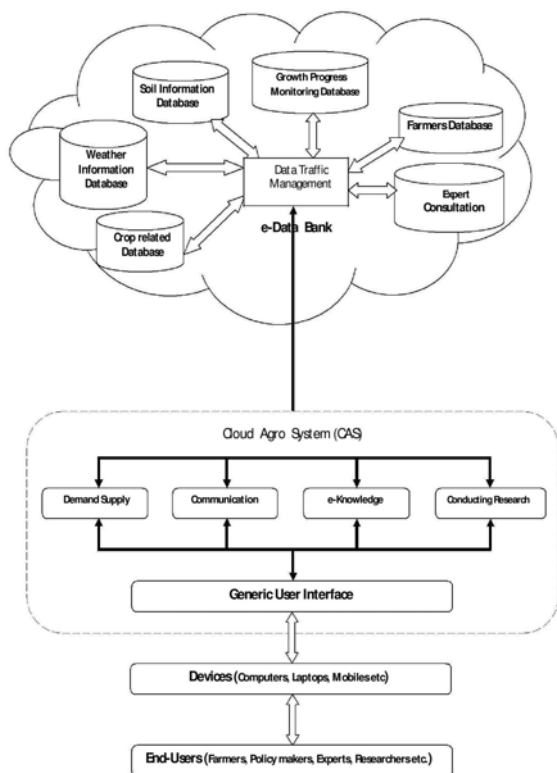
BENEFITS OF THE PROPOSED MODEL

The suggested model, if implemented properly, will benefit all the concerned sectors to a great extent.

Following are the main advantages of using the suggested model:

• *Data management*: The data will be managed by the service provider, a team of professionals. That guarantees a better and organized management of data.

• *Data readiness*: The model provides data from the e-data bank databases to its entire stakeholder at any time and at any location.

• *Local and global Communication*: The model makes the communication between different users much faster, easier and cheaper. Also the communication will be secured.

• *Rural-urban migration*: A major problem of Bhutan is rural-urban migration. It can be reduced as the model provides its services all over the country at any time no matter how remote the place is. This will also help in controlling unemployment problem in the country.

• *Motivation*: It will motivate the farmers and researchers to get involved more and more into agriculture as any communication will be result oriented. That will result in overall development of this sector in the nation.

• *Security*: It provides an enhanced security as the resources will be stored in cloud and will be maintained centrally by the service providers. Thus, it is not a cause of concern for its users.

• *Reduction of technical issues*: It cuts short the man power, maintenance and infrastructure requirement drastically, as it will be provided by the service providers.

• *Overall economy*: Implementation of the suggested model will help in uplifting the Indianagricultural sector of the country. That will boost the overall development of the economy. It is due to the mass involvement of different stakeholders, as the system will monitor and deliver progress report whenever and wherever needed.

FEW CONCERNS

Although the implementation of the proposed system indicates overall growth of the Indianagricultural sector in Bhutan, there are few concerns as well.

One of the main concerns of cloud computing is the conflict in different country laws. This will be applicable to Bhutan, as there is no cloud service provider in the country. Therefore, Bhutan has to look for service providers outside the country. It demands a careful selection of the provider and may also require negotiation in drawing an effective agreement between the service providers' nation and Bhutan.

Another concern is the security and privacy. The nation may not be willing to hand over sensitive data to a third party. This can be taken care of by careful selection of reliable and reputed cloud service providers.

One more important constraint is, cloud computing demands high bandwidth internet connectivity. The current international bandwidth of Bhutan is 622 Mbps, which is just sufficient to cater the basic needs. But to optimally use the cloud services Bhutan needs much higher bandwidth than the current capacity. One possible solution to this problem could be to incorporate certain services through mobile, especially text related services.

CLOUD COMPUTING FOR RURAL INDIA

Rural India

The real India lives in its villages and smaller towns and therein lies the future of India. Some key facets of rural India are:

- Rural India constitutes 69% of India's population
- 86% of the rural population earns less than $2 per day

Here are some more highlights from the IMRB/I-Cube report (as of March 2008):

India's rural population: 568m; rural literate population: 368m; rural English-speaking population: 63m; rural computer literates: 15.1m; rural (claimed) Internet users: 5.5m; active Internet users: 3.3m.

Finally, there are more phones than radio sets in rural India (100 million is the existing subscriber base).

Rural India has been ignored for more than 60 years and the Cloud will bring the change that is required to bridge the divide between rural India and urban India; and will improve the Indianrural economy.

The Government of India provides broadband connectivity up to the Taluk level today, which makes data connectivity a reality for rural India. This allows rural India to log on to the Cloud.

CLOUD IS GANDHI ENGINEERING

The term "Gandhi Engineering" was used by NY Times in an article on the Tata's Nano and it defines Gandhi Engineering as "a mantra that combines irreverence towards established ways, with a scarcity mentality that spurns superfluities."

The Cloud computing is a marvel of Gandhi Engineering and encompasses low cost; high operational efficiency; elasticity and scalability.

Advantages of Cloud Computing for rural India

- Low start-up cost makes Cloud computing especially attractive for rural India.
- Ease of management – no concerns about procuring licenses, or for that matter, power and air-conditioning
- to run the data centers, or purchasing additional hardware.
- Scalability makes rapid rural penetration a reality; one can easily expand the number of users and locations at a modest cost.
- Device and location independence. The way you access a Cloud, could be your desktop. It could be someone else's computer. It could be a smart phone. It could be a solar powered touch pad.
- Lastly, the BSNL broadband project for rural India provides the data connectivity, which will be the game changer.

What can be done for Rural India using the Cloud

The Cloud allows information technology to be infused into the smallest hamlet of India and makes access to information available to the poorest of the poor to give them a better life, by empowering them with knowledge derived through the laptop or mobile phone connected to the Cloud. The Cloud makes the following services affordable and accessible at a low cost:

- Banks
- E-learning
- Tele-medicine
- Commodity/stock exchanges
- KYC and credit bureaus
- Indianagricultural information
- Citizen interface portals

India will benefit by taking the Cloud to Rural India because:

- The Cloud has potential to drive down costs of e-Governance, education, medical care and other Government computerization initiatives.
- The Cloud bridges the great divide between rich urban India and poor rural India, and gives the same level-playing field to all Indians.
- Lastly, the Cloud enables non English speaking literate Indians to join the information revolution and participate in governance and the future of the country by allowing them to transact on the web in the Indianlanguage of their choice.

CONCLUSION

Bhutan will benefit significantly if the model is implemented properly. The model bridges information gap within and outside the nation. In Indianagricultural sector, the suggested model can be considered as a pilot project. An effective implementation of this model will encourage other sectors also, which will lead to optimal benefit of shifting towards cloud. This will definitely have a positive impact in the overall economic development of the nation. Above all, cloud computing is a newly introduced concept and most of the developing nations are not readily willing to accept and implement it. Therefore, it needs a mass awareness and promotion among the prime stakeholders to acquire the full potential of it and have a well established information base for the nation. This will in return lead to a well-connected world.

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