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2014 International Conference on
Information Systems & Computer Networks
(SAT-SUN) March 01-02, 2014
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Organized by: Department of Computer Engineering & Applications, IET, GLA University, Mathura, UP

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Introduction
Computer networking underlies today’s mobile devices, home networks and the Internet. Computer Networks have undergone a dramatic change in recent years. There is a paradigm shift away from the traditional client-server model to systems based on the peer-to-peer network, which allows users to share resources effectively. The size and scale of the Internet is a testimony to well designed networking protocols that have scaled beyond everybody’s imagination.

Information systems are the software and hardware systems that support data-intensive applications. Up-to-date, complete and accurate information has now become a necessity to survive in an increasingly competitive world. Information Systems address the challenges for the gathering, processing, storing, distributing and use of information, and its associated technologies, for society and organizations.

Call for Papers
The Second International Conference and 9th conference in sequence, Information Systems & Computer Networks (ISCON - 2014) is a forum in which deliberations will be held on various topics pertaining to Information Systems and Computer Networks. ISCON-2014, is an international conference where theory, practices, and applications of Information Systems & Computer Networks and related topics are presented and discussed. Original contributions are solicited on topics covered under broad areas such as (but not limited to):


Submission
Prospective authors are encouraged to submit their paper through EasyChair. The submission link is available on the conference website. Submissions must be plagiarism free and no longer than 5 pages in IEEE format.

Proceedings Publication
Accepted and presented papers will be considered for publication & indexing in IEEE Xplore.

Best Paper Award
In each track, an award will be given to the Best Paper Presented.

Important Deadlines
Paper Submission: October 30, 2013
Notification of Acceptance: November 30, 2013
Last Date of Registration: December 20, 2013

Registration Details
All delegates are required to register for the conference as per the details given below:

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- Non Members:
  - Rs.8,000/-
  - Rs.5,000/-
- Students CSI/IEEE Members: Rs.6,000/-
- Foreign delegates: Rs.10,000/-

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President's Message

Hon'ble Minister for Law and Justice, Communications, and Information Technology Shri Kapil Sibal Ji, my colleagues in Computer Society of India, Distinguished Invitees, Ladies and gentlemen,

First of all I would like to place on record my sincere thanks to Shri. Kapil Sibal Ji for readily agreeing to participate in today's function and grace the occasion. Sir, your presence is a great source of inspiration to all of us in CSI.

We are releasing the Golden Jubilee logo to mark the occasion. The logo will become part of all our communication from 6th September 2013.

An interesting Panel Discussion on “Kal Aaj Aur Kal” – Role of CSI in the Modern Cyber Era is scheduled as a part of the event. We are expecting some of the best talent from India to join us during the panel.

Dr. R. Chidambaram, the Principal Scientific Advisor to the Government of India and Chairman, Scientific Advisory Committee to Cabinet has kindly agreed to Chair the Panel. Our beloved past presidents – Shri S. Mahalingam and Dr Ratan Dutta have agreed to participate in the panel and share their views with us. As our members, Secretary, Department of Electronics and Information Technology, Ministry of Communications and Information Technology, Government of India has kindly agreed to be with us for the function and be part of the panel.

As the event is in New Delhi, the RVP of Region-I, Prof. R K Vyas and his team of Chapter office bearers of that region are doing everything possible to make the event a grand success. I must mention Prof Hoda, Shri Shankar Lal, Rajeev, Shiv, Mani, Baskar, … and a host of others who worked assiduously with unfathomable zeal and enthusiasm to make this a very memorable occasion. Of course, our veteran CSI enthusiast Dr Ratan Dutta, Past President of CSI and Chairman of the Nominations Committee, is guiding us through every step and is a source of inspiration to all of us. Hon'ble Minister Sir, CSI is proudly marching in to a Golden Era deriving strength and confidence from its Golden legacy. Having started in 1964 as a Computer User Group and registered as a society in 1965, CSI has come a long way and the Executive Committee decided in its meeting in April this year to celebrate in a fitting manner. Two year long celebration across the country was the vision set by them. That is the reason for the Curtain Raiser function today. 2013-2015 has been perceived by CSI-ians as the Golden Jubilee celebration period that you have agreed to launch today. Execom also expressed that there can be no other place for such historical occasions than “Rajdhani”. We are grateful to you Sir, for being with us during the Curtain Raiser.

Let me take this opportunity to place before you the august audience a few facts about CSI. The size of CSI is unique with 40+ Chapters; 450+ Student Chapters; 200,000 members, including student members.

CSI has done nation proud by many of its past achievements in true spirit of Bhagwat Gita – Karmanyevadhikaraste ma paleshu kadachana - and gave it to the nation in various forms and formats. CSI started O, A, B programs and transferred to DOEACC – which later became NIELIT – Plans are on to make it a University. It is now part of the Department of Electronics and Information Technology, which you are presiding over as its Minister. CSI started the Software activity as a software user group - Nurtured the software industry in its infancy – Created NASSCOM – by Shri. F C Kohli, Harel. Shri J. Satyanarayana, Secretary, Department of Electronics and Information Technology, Government of India in Human Resources Development, it is to be noted that one of the past CSI annual conventions, the one held in New Delhi more than a decade ago, nucleated the idea of IIIT for India. Besides, CSI – for initial 20 years – did IT Manpower training for PSUs and Banks – Government recognized the CSI Training – Banks recognized the CSI “Training and Certification” and reimbursed the expenses of their employees – In fact, the CPPDs in Banks were “manned” by CSI Certified Professionals for a long time.

But Sir, CSI retained the scholastic part as Software Division and Hardware Divisions. CSI Annual Conventions – Was the Main place and was the only place till mid 90’s – for Hardware and Software industry – Now focuses more on user needs. Vizag is getting ready to host the CSI Annual Convention this year in December. In terms of idea generation, input to Government of India in Human Resources Development, it is to be noted that one of the past CSI annual conventions, the one held in New Delhi more than a decade ago, nucleated the idea of IIIT for India. Besides, CSI – for initial 20 years – did IT Manpower training for PSUs and Banks – Government recognized the CSI Training – Banks recognized the CSI “Training and Certification” and reimbursed the expenses of their employees – In fact, the CPPDs in Banks were “manned” by CSI Certified Professionals for a long time.

Sirs, I would with your kind permission, marginally transgress the limits of modesty and humility and state for the sake of membership gathered here, that we feel that CSI has done “India Proud” by its thought, word, and deed.

We have some significant activities and achievement to report on the international front. School children of India – SAARC and SEARCC Competitions – Indian team won the First Place many times. CSI represents India in IFIP – International Federation for Information Processing; has brought many IFIP conferences to India since 80s, during times when Indian presence in this area was relatively unknown to the world.

During an occasion like this CSI is proud to look at our membership scroll, which sounds like a “who is who” in India. Shri. F C Kohli - TCS - one of the Past Presidents, Shri. Shiv Nadar – HCL – Life Member, Dr. M G K Menon – Distinguished Fellow, Shri. Sam Pitroda – Distinguished Fellow, Shri. Rajendra Pawar – NIIT – Life Member – Coordinated the Bank Training Program on behalf of CSI, Dr. N. Seshagiri – NIC – Member, Shri. Harivaranamurthy – Infosys – Life Member. Of course, I must mention my dear friend Satya, Secretary, Deity who is a Life Member. Sir, I am sure you recognize each one listed just now. There are many more.

As we launch our Golden Jubilee celebrations, we can contribute towards creating India - NexGen. Perhaps, a few years from now, we will see news item that may read as follows:

India is most connected country in the world. India has its own Search Engine. India develops world's fastest router. India creates history by driving 1000 Terabits of data through a pair of Optical Fibers across the country. India unveils world's largest Supercomputer. Indian software assets take the world by storm. India has the largest number of software design professionals. India moves on to Quantum Computing and Communication after unprecedented success in Silicon based computing. In India, every third person is an electronics designer of sorts. India becomes the largest designer of custom-made products. India successfully integrates 3D Printing technology and personalized product design.

When it happens, Computer Society of India should be perceived as the anchor for such change. With your blessings, we would like to put our acts together and make the necessary moves today. Everyone in CSI has a significant role to play in such transformation. Each one of us would like to do our bit.

Another important factor that CSI should focus on is the Academia – Industry interaction. Indian academic system have always excelled and remained comparable to the best in the West. Indian industry today is moving its attention more towards products as opposed to services. Indian industry is looking up to academia for help. CSI being body of professionals from academia and industry is in a unique position to address this need. The exact force, the students are also CSI members.

On the publication front, we have CSI Transactions on ICT, which is doing very well. This is besides a regular monthly CSI Communications that we send to our members. We are getting a constant flow of articles from our educational system. Our Board of Editors is doing a wonderful job in reviewing. I would like to appeal to those of you who are in academia and research to encourage the students and professionals near you to submit their work. Wherever necessary, help them reach the existing standards that our Editorial Board sets. You will be doing a yeomen service to CSI as well as the fellow professionals and more so, our dear student members.

The natural next question perhaps is “What can CSI do for Government?” CSI can participate in Government Policy, Planning, and Standardization Committees. CSI can prepare Technology Foresight and Technology Forecasting Reports periodically. CSI can participate country-wide in Human Resources Development - Skill Development – Finishing School – Research and Development – Encouraging Innovation – Help in Incubation; perhaps a host of other engagements.

Sir, kindly permit me share our members sentiments and request; this relates to “What can Government do for CSI?” Of course, government can help CSI with annual financial support; Sponsor CSI’s participation in IFIP at all levels; perhaps, make a CSI Bhavan in Lutyen's Delhi!

With best wishes,
Prof. S V Raghavan
President, Computer Society of India
Dear Fellow CSI Members,

Agriculture has been one of the important sectors for countries like India and many of livelihoods are dependent on the same. Such livelihoods are mostly located away from urban and semi-urban areas and mostly living under lower economic and social conditions. Thanks to ICT which has evolved to empower individuals with computing power, which has become accessible to everybody irrespective of location in the world at affordable price; and this is very much required for sectors like agriculture. Mobile phones have been one of such technologies, which are affordable, accessible and which make individuals stay connected, share what they have and always keep them informed. Lot of innovations are happening around and various apps are being developed to take advantage of mobile computing. Of course there are various other technologies also like satellite imaging, image processing, machine-to-machine technologies, wireless and wireless sensor networks that have been researched, experimented and successfully deployed in agriculture sector in India and various countries. There are many projects initiated by governments, research labs, NGOs and private sector firms. We are happy to inform you that we have received a very good response from various communities to our announcement for this theme of ICT in Agriculture; we could not cover all the contributions in one issue and would be carrying rest in the next issue.

We start this issue with covert story: ICT in Agriculture by Dr. Deepali Kamthani, Associate Professor, Bharati Vidyapeeth’s Institute of Computer Applications and Management, Paschim Vihar, New Delhi. She explores the areas where ICT can be used in agriculture and tries to make a broader framework for its application. She thinks ICT can play a bigger role in overall development of agriculture sector in India. Since farmers have limited access to resources and have to rely on middlemen to dispatch their farm produces such as vegetables to end customers, they are at the mercy of these middlemen and do not get the right price for their efforts; and end consumer has to pay more price. Next cover story article by Suresh Thiagarajan, Service Architect, Startrun Training Academy & Director, ProfessionalHub, Fermata Consulting proposes a supply chain management framework for farmers’ produce using DTU – Direct To you concept to tackle these issues and connect farmers to consumers.

In technical trends section, we have two articles, the first one about role of social media in agriculture by Prof. Krunal Kamani, Assistant Professor (CS), Sheth M. C. College of Dairy Science and Dr. Dhaaval Kathiriya, Principal & Dean, College of Agricultural Information Technology and Director (IT), Anand Agricultural University, Gujarat. The second article covers Wireless Technologies for Indian Agriculture and is contributed by Prof. Chintan M Bhatt, Assistant Professor, CSPIT, Gujarat University.

We have two articles in research front section. The first one on Applications of Mobile Sensing Technologies in Precision Agriculture by Bhushan Jagyasri, Jayantrao Mohite,TCS Innovation Labs Mumbai and Srinivasu Pappula, Head, Agri-Business Initiatives, TCS and the second one by Sapan Naik and Dr. Bankim Patel of Shrimad Rajchandra Institute of Management and Computer Application, Uka Tarsadia University, Bardoli, Gujarat, who propose a model for automated fruit sorting using image processing and machine learning techniques and algorithms.

We have two articles in article section. The first article covers scope of ICT in agriculture, describes few services, outcomes of various services and challenges in Indian context by Dr. G R Sinha, Professor and Associate Director, Faculty of Engineering and Technology, Shri Shankaracharya Technical Campus, Bhilai, Chhattisgarh, India. The second one is by Kasina V Rao, Research Scholar, SIMSOM, IIT Bombay, who takes a look at ICT initiatives in Indian agriculture, mobiles in agriculture, information services and delivery modes and benefits to the farmers.

In our regular practitioner workbench column, Umesh P and Silpa Bhaskaran continue their write-ups on operators and control structures in R under Programming.Learn("R").

We have a new section called IT Industry perspective covering interviews by professionals who have spent most of their career in IT industry. We are fortunate to have interview of well-known personality, Achyut Godbole who has spent more than three decades in IT industry being at the helm of affairs. The interview is taken by our resident editor, Ms. Jayshree. The interview covers various facets, issues and current status and future of IT industry in India.

Under Information Security section in Security Corner we have fourth article in the series on Web Application Security by Krishna Chaitanya Telikicherla and Harigopal K B Ponnapalli of Infosys on JavaScript and Cross Origin Security Restrictions. In this article, they write about typical errors developers make while using APIs of new libraries/ technologies based on JavaScript by not focusing on security restrictions imposed on JavaScript by browser security model and provide guidelines on how to avoid this.

Dr. Debashish Jana, Editor, CSI Communications presents crossword for those who want to test their ICT knowledge in agriculture under Brain Teaser column. H R Mohan, Vice President, CSI, AVP (Systems), The Hindu, Chennai brings us the ICT News Briefs at a glance under various sectors in September 2013 under regular column Happenings@ICT.

On the shelf column comes with a review of book written by Rajeeb C Chatterjee titled “Learning Oracle SQL and PL/SQL – A Simplified Guide” by Prof (Dr.) Ananda Mohan Ghosh and Chandan Giri.

We have other regular features like CSI Announcements, CSI Reports and Chapter and Student Branch News. Remember we eagerly await your feedback and welcome it at the email id csic@csi-india.org. Do drop in a mail if you like the articles or even if you do not like them. Do provide your suggestions on what you would like to read and learn about.

With warm regards,
Rajendra M Sonar, Achuthsankar S Nair, Debashish Jana and Jayshree Dhere
Editors

Editors
Rajendra M Sonar, Achuthsankar S Nair, Debasish Jana and Jayshree Dhere

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ICT in Agriculture

With NAREGA and direct subsidy to home, Govt. of India is trying to give direct benefits to the rural masses of India. For centuries Indian villages and its people are disconnected with cities and development cycles. They are either directly connected to cities through swampy roads or indirectly through electronic medium TV / radios. In such scenario we can realize how information and communication touch the masses of rural India. Information and Communication Technologies (ICT) can play an important role in connecting rural sector with rest of the country. Not only connecting but also uplifting their standards with levels in the rest of the world. As rural India largely depends on the agriculture and years after years the contribution of agriculture in national GDP is coming down. In such situation it is imperative to think about increase in the productivity of agriculture and use ICT towards this goal.

In this article author has explored the areas where ICT can be used in agriculture and tried to make a broader framework for its application. It is very heartening to see that ICT can play a bigger role in overall development of agriculture sector in India. We can see that ICT is already touching rural India and agriculture in the following forms:

1. ATMs.
2. Kisan Credit Cards.
3. Mobile Phones.
4. Television and Radio.

ICT is any device, tool or application that permits the collection, processing and storage or exchange of data. ICT is an umbrella term that includes the use of any device from mobile phones to ATMs. With the mobile revolution in India ICT affordability, accessibility and adaptability have increased and resulted in their use even within impoverished rural homes relying on agriculture. ICT can improve information exchange within global supply

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<th>Government (G)</th>
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</thead>
<tbody>
<tr>
<td>(F) F2B</td>
<td>Crop forecast estimates from the fields; Extension requirements, e.g. loans, insurance, fertilizers and subsidies.</td>
<td>F2R</td>
<td>F2G Crop forecast and yield data for import/export forecasting; Skilling and reskilling requirements of farmers; Advocacy regarding what government should supply.</td>
</tr>
<tr>
<td>(R) R2B</td>
<td>Research findings and important new research areas; Product and market information informed decision making.</td>
<td>R2F</td>
<td>R2G International trends and practices assist government to redefine Policy elements; Sharing market intelligence and scientific research to facilitate sector development policy decisions</td>
</tr>
<tr>
<td>(B) B2B</td>
<td>Demand, market trends, possibilities of new products, quality requirements; Prevailing products prices; Virtual markets that link producers and consumers.</td>
<td>B2F</td>
<td>B2G Employment-related information; Facilitating internships and training for skills development; Forecasting skills requirements and skills availability.</td>
</tr>
<tr>
<td>(G) G2B</td>
<td>Information and applications for licenses, subsidies, tax breaks and incentives in establishing new markets and products; Advocacy; Schemes and subsidies; E-services offered for better implementation of schemes, plans and strategies.</td>
<td>G2F</td>
<td>G2G Schemes and subsidies for research promotion and priority areas for research; Data for researchers and links between researchers and other stakeholders; Single-window onestop-shops to all services.</td>
</tr>
</tbody>
</table>

Table 1: Mutual information and services requirement among stakeholders group.
chain. It can help in integrating the gaps in it and faster information exchange.

**Areas Where ICT can Help:**

1. Economic Development
2. Helping small scale farmers at low cost.
3. Integrating farmers, traders, researchers and government.

Four main groups can be identified in the agriculture sector each of which includes several different subgroups. These are:

1. Businesses including: associations and other organizations.
2. Farmers including: individuals, organized and unorganized associations.
3. Researchers including: educators and trainers.
4. Governments including: Ministry of Agriculture, Departments and Parastatals.

The table shows the type of services and information that different stake holders exchange with one and another. This information exchange can be facilitated by use of ICT.

**From a farmer’s perspective, the cropping cycle typically goes through three stages:**

1. Pre-cultivation, including crop selection, land selection, calendar definition, access to credit, etc.
2. Crop cultivation and harvesting, including land preparation and sowing, input management, water management and fertilization, pest management, etc.
3. Post-harvest, including marketing, transportation, packaging, food processing, etc.

**ICT can play a vital role in the following way to help the farm throughout the cultivation cycle esagu an IT based agro-advisory system has been developed by IIIT Hyderabad.**

A common platform for all agriculture participants has many advantages. It minimizes the duplication of data and ensures consistency, improves integrity of the data, and addresses a variety of requirements. Although often quite complex, the system can be customized to ensure that the user experience of the system as relatively simple. Cost and time spend on maintenance is relatively low and the amount of user training required can be reduced. Multi-dimension research partnerships (also referred as participatory knowledge quadrangle of farmers, extension professionals, educators and scientists) have many benefits as they emphasize relevance in research, can reduce the time required to complete research, and improve the efficiency and effectiveness of the research process. The following applications of ICT in agricultural knowledge sharing are identified and their value is explained:

1. ICT for multi-dimensional decision making
2. ICT infrastructure to connect the knowledge quadrangle of farmers, extension professionals, educators and scientists as explained above.
3. Entities / individuals lacking fast and affordable internet access
4. Multi-channel information delivery
5. ICTs for spatial analysis and targeting of programs
6. ICTs for better risk management
7. ICTs and financial services for the farmer
8. ICTs and information gaps

**Advantages of ICT can be summarized as follows:**

1. Real economic value was added either because of savings resulting from the use of ICT or an increase in revenue or profitability.
2. The language and medium used to communicate with the farmers were important contributing factors in the farmers’ response to the program.
3. Good conceptualization and execution was achieved by including multiple-agencies in win-win partnerships.
4. Trust was built with stockists, support centre operators and even the Government by using local champions as facilitators. This is an essential element for success in any system.
5. Planning was often augmented by bundling many services together with the basic or original facilities to make them truly comprehensive.
6. Additional faith and trust in the system are created when a solution is developed locally.
7. Other community members find it particularly useful if other farmers are directly involved in training and can demonstrate a solution.

| Access To Market Information | To help farmers find out about market prices. This helps them make decisions regarding when to harvest, how to negotiate with intermediaries, and so on. Often combined with other information such as weather forecasts. |
| Distribution and Supply Chain Management and Traceability | To increase efficiency and predictability, reduce spoilage, and more. To record movements along the value chain, respond to quality standard requirements, and help large buyers track, manage, pay, and reward small producers. |
| Farm Extension Services, Access to Sector Experience, Research, and Other Resource Information. | Using ICT to deliver better farm extension services (utilization of best agriculture practices, research, weather, climate and more). |
| Commodity Exchanges/ Warehouse Receipt Systems | To provide transparency in price discovery and to facilitate better prices and efficiencies between buyers and sellers. It avoids moving crops themselves, reducing spoilage, transportation, and transaction costs. Exercises temporal and spatial arbitrage. |
8. In instances where farmers will be able to identify personally with a technology solution they would be more inclined to adopt it and continue to use it.

**Conclusion**

Having the support of government is seen as a very important factor in ICT projects and the inclusion of private sector partners and donors is also extremely important. The establishment of an Agriculture Hub is proposed as a very specific way of strengthening these relationships and allowing for them to be productive. However, full and sustained commitment from all the partners, including those on the ground is required.

Creating a sense of community ownership is important. Various communities exist and commercial farmers are one important community, smallholders another, and some communities are diverse with members from across the value chain. Overreliance on any one partner, supplier or technology is unwise, particularly in the case of technology and a multiple approach, with alternate forms of media is required so that, once operational, the project does not collapse if one technology is unavailable even for a short time. A sense of urgency is necessary to get any large project off the ground but this must go together with proper planning including financial planning and getting any necessary legislation or regulations in place, as well as a full assessment of many aspects of the current situation.

Planning for ICT infrastructure, end user training, design and implementation of systems, on-going maintenance and support are all required. However, it is not only the technological issues that will need attention in ICT, change management plays an important role in the introduction of ICT solutions in order to ensure sustained use.

**Reference**


**About the Author**

Dr. Deepali Kamthania, born on July 23, 1975 at Aligarh, (UP). She had received post graduate degree (MCA) in 1999, from Aligarh Muslim University (A.M.U.) and doctorate degree from Indian Institute of Technology, Delhi (I.I.T.D) in 2012. She is working as Associate Professor at Bharati Vidyapeeth’s Institute of Computer Applications and Management (BVICAM) for last 11 years. She has also worked with India Infotech, Verticalbiz.Com and Foxboro (Australia) Pvt. Ltd. Her areas of interest are Artificial Neural Networks, Solar Thermal Applications and Data Warehousing and Mining. She has published over 30 research papers in International and National Journals of repute. She is life time member of CSI and ISTE.
Introduction: DTU has the primary objective of directly connecting the farmers’ produces (specifically vegetables) to the end users like crores of populace like us. The goals of the initiative are to enable 1. Farmers earn an appropriate price for the vegetables they produce and 2. End users buy the vegetables at a cost that is not arbitrarily determined by middlemen and retail vendors.

Background: Traditionally vegetables from farmers were procured in ‘mandis’ through middlemen. These middlemen used unscientific means to judge the quality of the commodities and set the price of the commodities arbitrarily. As a result, the difference in price between good quality and inferior quality was little and therefore there was no incentive for the farmers to invest and produce good quality output. Also these middlemen in local ‘mandis’ and the retail vendors used to fix huge profit margin of around 200% to 600% on the vegetables purchased from the farmers. As a result, end users are forced to pay more.

In Fig. 1, the purchase prices of vegetables (procured from the farmers) are compared with the prices of vegetables sold by retail vendors (in this case, HAL Market). It may be noted that for certain vegetables, the profit margins are 700% & 900%.

** The wholesale mandi rates provided is the average of rates found across various locations within Karnataka. For E.g., Beetroot was bought at a minimum of Rs. 35 per quintal and at a maximum of Rs. 145 per quintal depending upon its location being Chikkaballapur or Bangalore.

History of initiatives to improve the situation: 1. E-Choupal is an initiative from ITC Infotech started in the year 2000 to address value added agri commodities like soya, wheat, marine products, tobacco, coffee etc. ITC Infotech established internet Kiosks and provided assistance to farmers to search and find the mandis’ that is the nearest and offered a best price for their commodities. ITC also stood benefited in procuring such commodities (E.g. tobacco) for their own processing and selling including exports. The initiative became India’s largest internet based intervention connecting 40,000 villages in 14 states through 6500 e-choupals servicing over 4 million farmers.

2. Farms n Farmers (FnF) was started in 2010 by alumni of IIT Kharagpur and IIT Delhi with the aim of providing end to end solutions (right from field to market) to farmers producing various agriculture crops. It starts with a research of what crop is beneficial to grow considering the market trends, land condition and monsoon predictions. FnF engages local representatives who interact with farmers by way of providing quality seeds, guiding them with preparation, growing of the crops with preventive care and then harvesting them. FnF’s engagement continues with the marketing of the crops by collaborating with corporate organizations engaged in biscuit or flour production. But FnF’s focus is in the northern states, especially in Bihar it is serving 4000+ farmers.
3. **HOPCOMS**, the Horticultural Producers’ Cooperative Marketing and Processing Society established (in 1959) by Government of Karnataka provides fresh vegetables and fruits to the people and also offers reasonable price to the producers. It also provides training, technical advice and agricultural inputs as well as cold storage and marketing facilities to its 17000+ members spread across 8 districts and trading around 100 metric tons per day. The process steps include farmers getting formally registered with HOPCOMS, bringing their produces to the HOPCOMS collection centers once they receive an ‘indent’ from HOPCOMS, getting their produces graded, pricing of the produces and getting paid for the same. The bought produces are sold at 260+ outlets within Bangalore.

Key improvement areas include a. price fixation based on the survey of local market prices which is arbitrary, b. grading of the produces done at HOPCOMS centers, increasing the risk of rejection or fixing of lower prices, c. the farmer spending on the transport of their produces d. not having more outlets and also that are close to the other retail outlets like HAL market and e. using conventional methods in raising indents and informing farmers.

4. **Safal Market** procures vegetables and fruits through a network of farmers’ association and collection centers and sells them to the end users at affordable prices. It also helps and trains farmers to adopt good pre and post harvest practices. It has around 1000+ farmers as its members and sells around 30 metric tons of vegetables and fruits per day (in Bangalore). Indents are raised on the farmers’ produces and the pick-up of the produces is arranged by Safal’s vehicle using standard containers and the expenses are borne by the farmers. Grading is done at Safal storage locations and pricing is fixed based on the local market rates, which is again arbitrary. Registration process is not formal and the price fixed for the farmer is not changed on a day to day basis. But for this all other improvement areas related to HOPCOMS are applicable to Safal Market also.

5. **Big super markets** buy the vegetables in bulk (approx 1000 Kg of vegetable and fruits) from the farmers at a price that is mutually agreed upon and sell them to the end users at a price comparatively cheaper than the retail vendors. A couple of such markets offer online purchases of vegetables and fruits but others are not selling on-line.

**Are these initiatives enough?** Certainly NOT. Let us look at the cost of vegetables at HOPCOMS outlets, Safal Market Outlets (Daily Fresh) and HAL market (retail vendors) to understand the reason.

Referring to Fig. 2, it can be seen that HOPCOMS prices are the cheapest for most of the vegetables and Safal comes next while HAL Market rates as the highest except for tomatoes. Big Super Markets’ prices fall somewhere in between HOPCOMS and Safal Market rates. In few instances their rates are comparable to HOPCOMS and/or HAL Market also.

The vegetable requirement of Bangalore Urban population is around 800 tons per day. Considering the capacity of HOPCOMS (@ 100 tons per day), Safal Market (@ 30 tons per day) and Big Super Markets (@ 50 tons per day), the balance 620 tons of Bangalore Urban requirements are being met by vendors like HAL Market, KR Market, KR Puram Market, Yeshwanthpuram Market, Russell Market and so on. These vendors offer vegetables more or less at the prices indicated for HAL Market (Fig. 2).

The price difference between vendors like HAL Market and that of HOPCOMS is varying anywhere between 10% and 170%. A similar price differences exist between HAL market and Safal Market, HOPCOMS and Safal Market and so on. All these price escalations are passed on to the end users, i.e., lakhs of common people like us. A sizable reduction of

![Fig. 2: Comparison of prices of vegetables sold in hopcoms, safal market and HAL Market*](image)

*Rates noted on a particular day*
these price differences done on 620 tons of vegetables per day will amount to
HUGE savings on the vegetable expenses
of the common man and some of it can
certainly be passed on to the farmers,
who are deprived of a reasonable price
for their produces. A similar analysis
at a state level will yield a much bigger
advantageous scenario.

Understanding DTU: DTU has three major
modules of innovation. 1. Farmer module,
2. Vendor module and 3. Infrastructure
module. The context diagram of DTU with
related modules and the interfaces are
given in Fig. 3

Farmer module consists of registration
of the farmers with their basic details
like address, phone number, land
area, location and bank account.
Farmer module is also responsible for
communicating with the farmers and
gets the yield details like vegetable,
its quantity & quality and its date of
availability for dispatch using structured
text messages and voice based SMS.
The data aggregated from the
registered farmers is used to determine the
rate for the vegetables using an algorithm
that takes into account vegetable quality,
quantity, the cost incurred by the farmer
for the seeds, preparation, labour, fertilizer,
pesticides, electricity and ‘guidance lease
value for the land’ (as published by the
Government of Karnataka). A minimum
profit margin for the farmer, the transport
cost, 5% of wastages and the profit margin
of the organization running the DTU will
also form part of the algorithm to calculate
the rate. The rates of the vegetables with
the quantity available and the address for
pickup are published to the vendor via SMS.

Vendor module starts with the registration
details of the vendor including name,
address, phone number, bank account
and email address. It also facilitates the
order booking of the vegetables that the
vendors would like to purchase. Vendors
may be HOPCOMS or Safal Market or Big
Super Markets or retail vendors in
HAL Market, Russell Market, KR Puram
Market, KR Market and so on. The
payment to the booked orders is collected
in advance online. The vendor module is
also responsible for sending information
(text message or voice message) and
transacting online payments.

Infrastructure module consists of a
registration feature that captures the name,
address, phone number, back account,
email address and the other statutory
details related to the vehicle owned by the
transporter like registration certification,
insurance, emission certificate, road tax
and state travel permit. The infrastructure
module also checks and grades the vegetable
as Grade A and Grade B and is responsible
for packing and identifying the package.
The information about the vegetable grade,
its quantity, farmers’ address for pickup
and the vendor who had placed the order
is conveyed to the transporters via SMS.
The transporter picks up the package and
delivers the vegetables to the vendor who
had ordered the same. On confirmation of
the delivery, the transporter and the farmers
get their payments.

Challenges, Solutions and Feasibility
1. Price fixing - Challenges: The current
‘culture’ of arbitrary fixing of prices
at local mandis or in HOPCOMS or
Safal Market is hard to break. It is
insensitive to the cost incurred and
eff ort exerted by the farmers. In
many areas, the concept of ‘auction’
based selling of vegetables to the
vendors is simply hiking the price
of the vegetables and the resultant
‘price gain’ is never passed on to the
farmers. All these build-ups are to be
shouldered by the end users like us
by paying more for the vegetables
that are purchased.

a. Solution: An algorithm to arrive at the
price of the vegetables produced by...
b. Feasibility: Refer to Table-1 where the tomato yield across 5 districts per acre is mapped with the cost of harvesting the yield and the price of the tomato that a farmer can get at the field, at the mandi is highlighted. The innovation of this approach is to assign a cost factor to each and every element that the farmer is using for the harvest that includes the land (lease) value, seed, fertilizer, pesticide, labour and so on. A profit margin is also taken into account depending on the (lease) value of the land.

It may be noted that price that the farmers get using the above algorithm is higher than the price they get at the mandi. However, the price that the farmers get at the mandi after deducting the transportation charges and their effort is lower than the price that they get at their fields. A similar approach has been done for other vegetables and it is found that the farmers get benefitted at large.

i. Solution: If these ‘services’ are provided to the farmers through banks and Government agencies, the farmers’ dependence on the locals will reduce over time. The services from the Government and the price fixation can also be extended to the locals.

ii. Feasibility: The subsidy from the Government and the price fixation algorithm will benefit both the locals and the farmers. Hence the chances for the buy-in of the innovation are more.

Table-1: Tomato yield, its cost calculation and the price to the farmer *

<table>
<thead>
<tr>
<th>District</th>
<th>Addakasalahalli (Chikballapur)</th>
<th>Allipura (Haveri)</th>
<th>A. Belaguli (Hassan)</th>
<th>K. Lakki Halli (Tumkur)</th>
<th>Achuthapura (Davagare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidence value / acre</td>
<td>93000</td>
<td>85000</td>
<td>115200</td>
<td>90000</td>
<td>180000</td>
</tr>
<tr>
<td>Lease value per year / acre - 5% of value</td>
<td>4650</td>
<td>4250</td>
<td>5760</td>
<td>4500</td>
<td>9000</td>
</tr>
<tr>
<td>Vegetable grown</td>
<td>Potato</td>
<td>Potato</td>
<td>Potato</td>
<td>Potato</td>
<td>Potato</td>
</tr>
<tr>
<td>Yield @ 2 times in a year</td>
<td>20000</td>
<td>20000</td>
<td>20000</td>
<td>20000</td>
<td>20000</td>
</tr>
<tr>
<td>Nursery / Seed</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
</tr>
<tr>
<td>Land preparation</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>Fertilizer + pesticide co</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>Irrigation</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>Labour</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
</tr>
<tr>
<td>Infra (bamboo, wire, surf)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>4000</td>
<td>4000</td>
<td>4000</td>
<td>4000</td>
<td>4000</td>
</tr>
<tr>
<td>Total cost</td>
<td>152650</td>
<td>144250</td>
<td>175960</td>
<td>149500</td>
<td>244000</td>
</tr>
<tr>
<td>Price per kg</td>
<td>7.63</td>
<td>7.21</td>
<td>8.80</td>
<td>7.48</td>
<td>12.20</td>
</tr>
<tr>
<td>Profit margin % (slab)</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Price for farmer</td>
<td>9.2</td>
<td>8.7</td>
<td>11.0</td>
<td>9.0</td>
<td>15.3</td>
</tr>
<tr>
<td>Whole sale price at mandi</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Transport cost to farmer</td>
<td>4500</td>
<td>4500</td>
<td>4500</td>
<td>4500</td>
<td>4500</td>
</tr>
<tr>
<td>Farmer effort (1 day)</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>Mandi price for farmer</td>
<td>7.90</td>
<td>7.48</td>
<td>9.06</td>
<td>7.74</td>
<td>12.46</td>
</tr>
</tbody>
</table>

* Numbers are indicative and based on friendly discussions with known contacts

Note: The algorithm explained is an initial one and will be reviewed and revised with the help of experts from HOPCOMS, Safal Market and University of Agricultural Sciences (UAS), Bangalore considering the risk of farmers not realizing minimum yield but expending a maximum cost and the subsidies that Government provides to the farmers.

2. Mindset of the Stakeholders:

a. Farmer - Challenges: Agriculture has been run with loyalty to the local people as the basis. The Chief of the village or the rich landlord helps the farmers in the form of lending short term loan, supplying seeds, providing transportation and so on. Hence the farmers are obligated to selling their vegetables to these locals.

i. Solution: If these ‘services’ are provided to the farmers through banks and Government agencies, the farmers’ dependence on the locals will reduce over time. The services from the Government and the price fixation can also be extended to the locals.

b. Vendors – Challenges: Retail vendors in HAL Markets, KR Puram Market and so on, are forced by the ‘commission agents’ to participate in the auction conducted at the market venue and buy vegetables only through these auctions. The farmers and the retail vendors are paying 10% and 5% (respectively) of the value of auction to the commission agents. Some of the retail vendors are also borrowing a ‘one day’ loan at a high interest rate from these agents that are paid back on the same day enabling them to conduct their business without an investment.

i. Solution: Banks in the vicinity of the Markets can provide short term loans that are recovered in more frequent installments (may be every week). Making the vendor transactions through banks will also help.
2. Establish HOPCOMS outlets close to these markets so that the retail vendors are forced to sell at HOPCOMS rates.
3. Government support in ‘abolishing’ the concept of ‘commission agents’ will help to a great extent.

ii. Feasibility: When the retail vendors get their needs satisfied and the ‘constraints’ removed, the implementation will not face any issue.

c. Infrastructure support: Challenges: The vegetables transported from the farmers are in the range of minimum 1000 Kg to maximum of 4000 Kg. Except for HOPCOMS and Safal Market, other Big Super Markets or retail vendors will not be able to consume such large quantities. It is essential to have transit distribution centers from where the retail vendors etc get their required quantities of vegetables. This calls for infrastructure support like storage, cold storage, personnel to manage the infrastructure and local transportation. Establishing the infrastructure as part of DTU will make the supply chain investment very heavy.

i. Solution: The support of HOPCOMS, Safal Market and any other Government and/or Agriculture Universities is made available.

ii. Feasibility: Considering the overall benefits accrued to the farmers and the entire populace at large, it is quite logical to expect this support.

d. Communication: Challenges: The fastest way of communication with the farmers, transporters and retail vendors with support of local languages (more than one) will require some technological creativity. Adherence to the statutory requirements related to sending SMS requires better planning from the service providers. The existing hardware (mobile phones) capability to fit into the communication requirements poses a challenge.

i. Solution: There are solution providers available who can transmit text and voice messages. They can provide additional support of getting a feedback from the receiver (farmer, vendor, and transporter) either in text or voice form. The registration process must ensure that the stakeholders agree to the mode of communication using text and voice messages. The hardware, if required, can be provided to all the stakeholders through a short term loan so that any user friendly mobile applications can make the implementation task simpler.

What are the Next Steps?

1. Protecting the innovation: The innovation has been protected through submission of Provisional Specification under the title “A system and method for providing direct supply chain management for farmer’s commodities with Patent Office, Intellectual Property of India, Chennai. (Application number: 3968/CHE/2013 & C.B.R. No: 12485)

2. Government agencies and Agricultural University: have the interface with farmers. Discuss with them and get their buy-in for the innovation. Arrange for agreements that ensure seamless integration of execution of tasks in line with the responsibilities taken up including providing infrastructure support (storage and cold storage areas, outlets nearer to retail vendor areas).

3. Transporters: Enter into agreements with transporters across regions / locations so that the pickup of vegetables are done and delivered to the vendors that have placed the orders.

4. Application development partner: Choose a partner for development of an end to end application that can manage the supply chain and enter into an agreement to ensure that the maintenance of the application is also taken care.

a. Plan to roll out the prototype during the launch of ‘Krishi Mela’ conducted by UAS, Bellary road, Bangalore in the month of November 2013 and get the buy-in of the farmers.

5. Vendors: Interact with the vendors (big super markets, hotels, hostels, resorts, hospitals etc) and get their registration for linking the final element of the supply chain.

6. Banks: Talk to banks adjacent to the areas of stakeholders (farmers, vendors and transporters) for any financial support in the forms of loans.

Future innovations: Once the above innovative system (DTU) is put in place and stabilized, another level of supply chain management can be improved as the online order or purchase of vegetables by entire populace of Karnataka (which is already in place on a small scale in the form of Big Basket, Taaza Bazaar etc).

Highlights of Innovation - DTU

- An algorithm to arrive a price taking into account the cost incurred by the farmers including their labor and land holdings.
- Grade the vegetables at the source (farmers’ land), identify and pack them.
- Online ordering of vegetables by the vendors (wholesale as well as retail vendors)
- Online ordering of services to pickup and deliver the vegetables by transporters.
- An innovation that has opportunity to integrate information, communication and technology.

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[3] Vegetables & Fruits Price list - www.hopcoms.karnic.in -> Rate List (History of initiatives ... pg. 1)
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[5] Revised Horticulture plan for Karnataka (GOI-Sep2005) nhm.nic.in/actionplan/actionplan_karnataka.pdf (Vegetable requirements ..... Pg. 2)
[6] Guidance value of lands in Karnataka - http://www.karunadu.gov.in/ (Table 1 ..... pg. 4)
Cultivate ICT & Networking: The Role of Social Media in Agriculture

Introduction
Agriculture is important to India’s economy. The need for current and relevant information by professionals in this sector for sustainable agricultural production is a key issue for the nation. Information communication technology facilities are greatly influencing how information is sourced and disseminated these days, and the latest trend is to use social networking sites.

Traditionally, agricultural information exchange has been dominated by industrial media such as newspapers, television, and magazines. In recent years, however, technology awareness and computer literacy are increasing across all demographics and various forms of social media are being used more and more by people looking for news, education, and other information related to agriculture. Social media can be defined as internet-based applications that allow the creation and exchange of user-generated content. It is the blending of technology and social interaction that creates value in these types of media.

Why Social Media
Is social media important to agriculture? While many outsiders would never think to associate farmers, dairy farmers, animal keeper with Facebook and Twitter, they actually represent on a large group of active users on both of the social networking sites. According to some farmers and tech savvy scientists, social media is an indispensable communication tool for farmers to connect with each other and educate others about their industry.

A recent article showcased as a farmer from foreign country uses social media to educate dieticians, politicians and consumers about farming. They also connects with farmers around the world running many different types of farms. We personally believe that more success encouragement younger farmers to jump on board with social media. While some farmers are resistant to social media, many are beginning to see the benefits of building relationships with other farmers and leaders in other industries and scientific community and continues to press the issue because in his opinion. Social media is another tool that can help farmers maximize output and profits.

Advances in technology have drastically changed agriculture production methods over the decades. Now, new methods of communication are also changing the way the public learns about agriculture and production.

Agriculture is becoming more diverse as a population and we are becoming further removed from the farm. It is important that agriculturists explore different communication options. New generations removed from the farm, meaning it has been two generations or more since they have lived on a farm or other agriculture related industry. Currently, we can’t rely on face-to-face communication anymore to tell their story. More and more farmers are becoming technology savvy and getting involved with social media to connect with consumers on a personal level.

In our opinion, agriculturists have to take advantage of as many tools as possible to convey the message of agricultural related issues. Agricultural industries are enhancing their development within social media and expanding their businesses to reach the general public. Industries are starting to hire social media specialist who monitor the social media buzz.

Social media is all about people. It is a way to build relationships, share information, and connect with diverse audience of people you may never meet in real life. So, interacting on social media, whether it is Twitter, Facebook, or YouTube allows you to develop a community and share your story in a way that was never possible before now. The most positive thing about social media is that you get to have a conversation with people about farming and it is instant, quick and allows you to have a relationship with users.

Use of social media generates a new audience. Twitter, Facebook, WhatsApp, Linkedin, Agropedia and YouTube allow farmers to tell their stories in their own words. The masses of people who use Facebook and Twitter create new ways to share with otherwise uniformed people. According to Statisticsbrain.com, there are more than 1.2 billion people who use Facebook worldwide. Farmers can share what is important to them and what changes they wish to see in the agriculture industry. Social media will help strengthen agriculture’s message.

Social media captures widespread users. Interesting stories trending on Twitter, WhatsApp, Linkedin, Agropedia or Facebook are more likely to be read than buried deep in a newspaper.

Popular Social Media Tools

- **Facebook:**
  According to survey Facebook is the world’s most popular social networking website as it makes it easy to connect with family and friends and share pictures, websites and videos. It allows users to create a profile, add friends, send messages and join common interest groups. In the same manner farmers can create a group and discuss the issues.

- **Twitter:**
  Another popular and precipitously increasing source of social media is Twitter. Twitter is quick and easy, allowing users to share 140 character messages. These messages are called “Tweets,” that are available to anyone who is interested in reading them.

- **YouTube:**
  YouTube is a video-sharing website where users can upload and view videos. With over 3 billion YouTube videos watched every single day and 48 hours of footage uploaded every single minute to the world’s most popular video sharing website we wanted to produce a useful guide for getting the most out of the service.

- **WhatsApp:**
  WhatsApp Messenger is a proprietary, cross-platform instant messaging service.
application for smartphones. In addition to text messaging, users can send each other images, video, and audio media messages. Provides zero cost communication facility.

- **Linkedin:**
  Linkedin is geared toward the professional community. It allows you to network with work colleagues and is a powerful for brands and job seekers. You can post your resume, connect with other professionals, and keep up to date with industry news. You can follow groups focused on topics relevant to your industry.

- **Agropedia:**
  Agropedia is an open-ended knowledge sharing platform. It is an online agricultural knowledge repository that makes agriculture information available to scientists, researchers, extension personnel and the agricultural community and allows them to search and make contributions to the vast knowledge base. It is a collaborative project of seven consortium partners' viz. ICRISAT-Hyderabad, NAARM- Hyderabad, IIT Kanpur, IIT Bombay, GBPUAT- Pantnagar, UAS- Raichur and IIITM-Kerala. Project is backed by Government of India and sponsored by the World Bank through the National Agricultural Innovation Project of the Indian Council of Agricultural Research (ICAR). The project was launched on 12 January 2009. Many social enterprises are currently addressing the agriculture space, attempting to bring new technologies to rural areas to improve the efficiency and profitability of farmers. Agropedia works as a one-stop hub for information on the agriculture ecosystem. The Wiki-style platform provides, among other things, a space for stakeholder interaction, best practice sharing, news updates, and an online library certified by the Indian Council of Agricultural Research (ICAR). Agropedia has also collaborated with Krishi Vigyan Kendra, a training and education center for farmer and rural entrepreneurs, to develop “Voice Krishi Vigyan Kendra” (vKVK), a mobile-based advisory system that sends SMS and voice-based messages to field officers and farmers around the country.

  It is a human psychology that, each of us have our own circle of influence. We need to convey the message of agriculture within our circles, so our stories can be influential.

Examples of Online Applications
- “The Story of Agriculture and Green Economy” YouTube video (http://www.youtube.com/watch?v=48H7zOQrX3U )
  This video successfully showcases the younger generation’s ingenuity and creativity through a positive depiction of farm life. The video is fun and witty, playing off a popular song, but it also has an important message. The video has received more than 7 million views.
- Agriculture Proud Farm Blog (http://agricultureproud.com/)
  Ryan Goodman’s Agriculture Proud blog is a great example of how one rancher, utilizing social media, can have a large impact on the public’s perception of agricultural practices. Goodman keeps his message positive and honest, which has gained the trust of his audience.
  In agropedia blog posted on 13/02/2013 by Debaleena Dutta discuss the climate change effect on kharif and rabi crop in the year 2012-13. This form is shared among entire agriculture community and farmers.
- “Keeping It Real: Through the Lens of a Farm Girl” (https://www.facebook.com/lens.of.a.farm.girl )
  This iconographic page showcases farm values through pictures and words. This method of social media is easily shared and attention grabbing.

All outlets of social media are available at the tip of your fingers; all you need is Internet access, particularly talking about Gujarat, India, the state government has covered the entire Gujarat with internet through E - Gram Vishwagarms Yojana. These kiosk allow people to participate in conversations and gather intelligent thoughts and insights. Technology has greatly impacted agriculture. Farmers and breeders are taking advantage of genetic advancements livestock, drip irrigation, dairy products, agricultural information technology and biotechnology in seeds, alternative fuel sources and GPS technology. Farmers can use social media outlets to educate the public on their increased use of technology.

Social media provides platforms to people and so as people are more willing to participate in conversation and consumers ask more questions. These social media channels also provide a platform for those who do not support of modern agriculture practices. Social media is only going to grow more conversation and it’s up to us to figure out more ways to connect and share our story.

Summary
Agriculture is a key sector in most developing countries, as the general opinion is that a happy nation is one that is able to feed their citizens. However, there is a need to make researches available and accessible to people if agricultural research is to achieve real impact on productivity and livelihoods. Social media will be useful tools in that regard because they surpass geographical limitations and are rapidly becoming the new shining of online society. The role of social media is to establish connections, create awareness. Hence, farming community, agricultural researchers, scientists and extension people should increase their participation to connect, network and communicate agricultural issues promptly on social networking sites.

Today farmers are sharing their stories through social media, and we believe that this is the start of a movement that will forever change the agriculture industry as we know it. Consumers need to know how and why we produce food the way we do, and internet technology is just the tool to help agriculturalists inform consumers. In order to continue utilizing advanced technologies in the field, agriculturalists...
will first need to connect the power of social media technology. The impact of that technology will be huge, and we are excited to see just how powerful this technology can be for agriculture.

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**Wireless Technologies for Indian Agriculture**

**Introduction**
India, the second most populous country in the world, represents ~17.4% of the world's population with 1.22 billion people. With a population growth rate of 1.58%, India is estimated to grow to 1.53 billion people by 2030, which would make it the most populous country in the world. This expected increase in population will significantly add to the demand on food production and increase the pressure on the agriculture sector and its prerequisites. The Green Revolution has significantly increased food production in India in the last 60 years (grain production increased from 51 million tons in 1951-52 to 250 million tons in 2012). In recent years, India has had the White Revolution (milk production), Yellow Revolution (Pulses), and Blue Revolution (Fish and aquatic productions), but they are not enough.

Agriculture is an integral part of the Indian economy. Two-thirds of the Indian population lives in rural areas, many of whom depend on agriculture for living. In fact, agriculture employs 53% of the total workforce. The share of agriculture and allied sectors in the gross domestic product (GDP) has declined steadily, from 38.8% in 1980-81 down to 14.2% in 2010-11. There is a growing divergence between overall economic growth and agricultural growth, which carries serious implications. 27% of farmers are not satisfied with farming as a source of livelihood because it is not always profitable; 40% would quit farming if they had a choice.

**Wireless Technologies**
Wireless (mobile) technology in a variety of forms is an area of electronics that is developing and growing particularly fast. Wireless LAN (WLAN) technology including Wi-Fi (IEEE 802.11), Bluetooth, Ultra-Wide Band (UWB), WiMax, Zigbee, and more are all growing and finding their own market areas. As a result wireless technology is being more widely used and found in many new applications.

With widespread expansion of cellular wireless networks and availability of affordable handsets, several companies started disseminating point information such as market rates, weather, and plant disease alerts. Other companies and government institutions have built agricultural databases and provided facility to query the databases using WWW. Though the above simple IT systems are of some value to farmers, IT has a much greater potential to create impact in agriculture. In fact, IT could become a core technology in all phases of agriculture; starting from seed research all the way to marketing of produce. The following examples can give an idea of how IT could be integrated with agriculture and how several solutions and services could be delivered to support agriculture research, education, extension, and marketing.

**Agriculture Issues and Problem Solution with Wireless Technologies**

The agriculture and food problems are listed under five categories: crop production; soil, water and weather; agriculture education and extension; marketing and agri-business; and livestock and fisheries. In this section we give a brief description of each category and provide a list of corresponding problems.

- **Crop Production**: Under this category we consider production related issues pertaining to cereals, pulses, fruits, vegetables, spices, flowers, oilseeds, etc. The topics under crop production include seed production systems and planting material, crop production systems, protected cultivation, farm mechanization, farm management, precision farming, pest/disease management, biotic stress management, post harvesting management and food processing systems.

  Wireless Technologies like Geographical Information Systems (GIS), Wireless Sensor Networks, Data Mediation Software, and Short Message Service (SMS) can be used.

- **Soil, Water, and Weather**: This category covers issues concerning better management of soil, soil mapping, weather forecasting, abiotic stresses, environment management, disaster management, and natural resources management.

  Several commercial weather station manufacturers sell low-cost, battery-powered data loggers with a soil moisture probe and a remote base station that can collect data wirelessly.

- **Agriculture education and extension**: We must cultivate the next generation of students’, scientists’, and professionals’ practical and advanced research
skills. Related goals are extending crop technologies to stakeholders (including farmers), reducing the lab to land gap, improving capacity building/training of stakeholders, and providing real-time advisory to farmers, and establishing farmer expert connectivity.

- Marketing and agri-business: The areas include efficient procurement, storage and supply of quality agricultural produce and processed goods to consumers, sale of produce by farmers, market intelligence, etc.
- Livestock and fisheries: This category is about scientific herd/flock management, management of semen stations and information on availability of semen, milk collection, storage and processing; production and availability of fish seed; marketing of fish and aquaculture produce; marine fishing and logistics; fish processing; and production, protection, education, extension, and marketing of animals and animal products.

We can use GIS, GPS, Laser scanning, Satellite imagery, Aerial photography and orthophoto mosaic can be used for Livestock and fisheries.

Information can also come as Big Data so the transfer rate of data needs to be handled through more bandwidth. Allowing data to be collected to a central location allows multiple users to utilize that data as per requirement. For example, weed scouting data collected in the field from a consultant using a handheld PDA equipped to a cellular phone or local wireless network system relays treatment information to office server. Server-side software generates an appropriate application map to grower and sent on to commercial chemical applicator for application at the same time.

Some limitations in collecting this data include transferring data to the appropriate locations or central databases, battery loss etc.

**Application of Wireless Technologies in Agriculture**

Electronic sensors can send environmental, water, soil, and crop data at specific intervals to an IT platform. This data can be integrated with crop models to predict plant disease. Such an IT-based test bed or platform is useful for agriculture research where electronic sensor-based field data and human observation can be observed remotely and combined to obtain desired results. Through collecting, arranging, analyzing, and processing such data, it would be possible to assess the impact of lab research in the field and use field information to influence research direction.

Tracking and tracing food in the supply chain is quite possible through use of an IT system especially with RFID which use light, temperature and humidity sensors. For example, tags could be placed with produce in the field during harvest, or in pallets being transported from the pack house to distribution centers. Readers and condition monitoring tags use battery-assisted, passive RFID to read through pallets and containers with precision. The tags are removed at the pack house and mailed back to main center for analysis that is included in a detailed report, including:

- Product’s experience regarding Temperature Variation
- Recommendations to improve temperature management

This level of reporting can help farmers, distributors and retailers develop cold chain best practices. By transforming climate monitoring from trailer, container and warehouse-tracking devices to individual pallet tags, RFID can give fresh produce suppliers detailed visibility into the lifecycle of the produce. They can use this new found visibility and resulting best practices to reduce shrink and improve

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**Fig. 2: Flow for Interactive Voice Response (IVR)**

Professionally recorded sound files

Develop call flow logic

The IVR is then connected on an incoming number

Outgoing calls are sent through a web-interface with this IVR.

Combined to make an IVR
profitability. Every fresh produce supplier's dream come through thanks to - of all things - RFID.

Crops can be tracked at the farm level using observations such as the amount of fertilizer and pesticide application through mobile-based local language applications. The information on location, farm, and the farmer who supplies produce can be captured in the form of bar codes on shipment cartons. The bar codes can be integrated with a tracking and tracing application, and hence, food purchased by a consumer can be tracked and traced to a farm.

IT has the potential to enable the transition of breakthrough science to large scale adoption. The package of practice (PoP) for new varieties can be embedded into an IT platform and can be disseminated using IVR (Interactive Voice Response) and/or SMS (Short Message Service) technology. The IT platform can pass on the names of non-compliant farmers to village workers who can schedule farm visits in a planned way and contact those farmers to ensure proper implementation of PoP.

Bio-technology research for developing pest resistant and drought resistant crops could be supported through IT techniques. A combinatorial approach is used to identify novel genes which produce crops with specific trait. Large scale trials are conducted to determine the most viable candidates. This process generates huge amounts of data which needs to be processed. Various data mining techniques could be used on terabytes of data to come up with an effective option for selecting the gene.

Conclusion
IT in Agriculture in India would have a significant impact on agriculture and livelihood globally. India has diverse farming situations due to diversity in the weather and geography. Some of the related issues are similar to those encountered in many other developing countries. For example, any IT-based solutions developed for agriculture in India could be transferred to several countries in South/South East Asia, and Africa. By producing high quality agricultural produce, Indian farmers would be able to compete in the international market.

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About the Author
Applications of Mobile Sensing Technologies in Precision Agriculture

Introduction

Agriculture is the backbone of Indian economy. The sector remains the principal source of livelihood for more than 58% of population though its contribution to the national GDP has declined to 13.7 per cent due to high growth in industrial sector but still it plays a significant role in overall socio-economic fabric of India. India has only 2.3 percent share in worlds total land area and it has to provide food security for about 17.5 % of world population, so rapid growth in agriculture sector is of prime importance to meet food security and provide employment in rural areas (Department of Agriculture and Co-operation, 2012).

Information is basic and fundamentally important element in any agricultural activity. It is useful only if it is available at right time and users have access in the appropriate form and language. There are number of ways by which information is disseminated to the farmers. One of them is Information and Communication Technology (ICT) which provides requisite information to the farmers at right time and in a cost effective way. The Information and Communication Technologies (ICTs) can create new opportunities to bridge the gap between sources of information and information seekers in the developing countries (Government of India, 2000). ICT also enables to collect the information from the field via sensing technologies like wireless sensor networks, mobile sensing and human participatory sensing which can be utilized by the experts for providing agro-advisory services.

In the current scenario of Indian agriculture, farmers are facing problems related to crop pest/diseases, water scarcity, weak linkages with agro commodity market, agricultural supply chain, transportation for agri produce and manpower (labour, equipments). Further these constraints along with the uncertainties of weather lead to the reduction in yield. Timely and accurate information about various agricultural aspects like crop pest/disease management, fertilizers and pesticides, crop scheduling, water management and market prices along with personalized advice specific to the farm based on dynamic weather parameters can be helpful for sustainable agricultural production.

Dissemination of information like commodity prices from nearby markets, disease/pest alerts and agro-advisory services can now be provided to the farmers through the ubiquitous mobile phones. Sensing technologies are maturing which can be used for bringing more and more farm parameters onto the experts desk in order to provide the personalized advisory services. Challenges faced by the farmers due to illiteracy and anxiety of using latest handheld devices can be surmounted by forming groups and by providing education, trainings and handholding in groups.

In this article, we present the different ICT and Mobile Sensing Technologies and the role played by these technologies in enhancing agricultural efficiency and in connecting farmers among themselves and with the concerned entities in the ecosystem.

mKRISHI®- Mobile Based Agro Advisory for Rural India

mKRISHI® is a technology framework for mobile based agro-advisory services which connects rural community with agricultural expert through mobile phone and sensor networks (Pande et al., 2010). Farmers can ask their queries in local language, in the form of text, voice or images related to market prices, cold storages, financial assistance, soil status inquiry, diseases, etc. mKRISHI® also provides experts advice to the farmers on their mobile phone instantly and cost effectively.

The mKRISHI® system consists of a) Sensing platform to collect real time data about weather parameters which can be transferred to the server through modem or cellular network. B) mKRISHI® mobile application through which a farmer can register, provide all necessary information and ask their queries. C) Experts console and mKRISHI® server through which expert can see all updated information related to farmers queries and provide the advice in local language.

In addition to the advices, timely alerts about pest/disease severity based on weather parameters or symptoms collected from the farm can be provided by mKRISHI®. Further, mKRISHI® can also act as channel between rural community and financial institutions for credits, loans etc. Periodic updates about weather condition, market prices, government policies are some of the other services provided through the system.

Sensing Technologies in Precision Agriculture

With the advancement of electronics and communication, the number of sensing technologies have emerged to cater to various applications in agriculture. We present some of the emerging sensing technologies like Wireless sensor networks, mobile sensing, human participatory sensing along with their applications pertaining to precision agriculture.

Applications of Wireless Sensor Network

Most of the existing platforms are based on weather station deployed to monitor environmental as well as crop parameters in agriculture. However to provide sensor based services to small and marginal farmers inexpensive sensing platforms are required. Wireless sensor networks is a network formed by the number of inexpensive small and portable sensor nodes deployed in an application area to monitor agrometerological parameters useful for precision agriculture application.

mKRISHI® sensor node is one of the promising solution for precision agriculture (Mittal et al., 2012) as it is inexpensive, robust, maintenance free and easily deployable on the farm. Different kinds of sensors can be interfaced with the sensor nodes to monitor the parameters at higher spatial resolution and transfer it to the node wirelessly. The data received from various nodes can be processed...
and transferred to the common gateway which can be further received by server. All these data about weather parameters can be used by the experts for predicting disease forecasting and for providing agro advisory services.

**Applications of Mobile Sensing**

Mobile phones are becoming essential part of our day to day life. Mobile sensing technology have been used for various applications in urban scenario like urban transportation, urban water management and event detection. We present the applications of mobile sensing platform in light of various problems pertaining to the rural masses of the developing countries. In this section, we present the use of sensors like camera, microphone, acceleration, GPS, Gaseous monitoring and spectrometer for different problems in agriculture.

**Detection of Pest using Microphone Sensor Data**

Every mobile phone has a microphone sensor which can be used for recording/detecting the voice. In agriculture, microphone as a mobile sensor can be used for the detection of pest presence in the field. These pest are detected by analysing the noise they make, by using signal processing, estimation and detection algorithms. This helps the farmers to take necessary measures in order to minimize the losses due to pest attack.

**Plant Disease Severity Monitoring using Mobile Camera based Human Participatory Sensing**

Plant disease is one of the major reason of the reduction in agricultural productivity for various crops across the globe. Although several mathematical agro-meteorological parameter based disease forecasting models are existing in literature, the insight on the actual disease attack on a particular farm would be helpful in several ways. The accurate detection of plant diseases can lead to personalized advisory services and the study of plant disease epidemiology. Mobile Sensing based Plant disease forecasting is one of the project carried out at TCS Innovation labs Mumbai, (Pande et al., 2009; Jagyasri 2012) in which camera is used as a mobile sensor for capturing the images from the farmers field. This sensing operation is done with the help of farmer’s/farm worker’s participation. These images captured from the field can be further analysed by Image processing and pattern matching techniques to results in the (a) the detection of the pest or disease attack (b) obtaining stage of a particular disease and (c) obtaining the disease severity from a particular farm. This information when provided to an expert can assist in advisory services for helping the farmers in taking the necessary precautions. This will in turn help to maximize their yields. With the participation of large number of farmers in sensing the symptoms that appear on the fields provides us more information on disease spread in space and time which can be further used to communicate the more precise alerts to the near-by farms.

**Mobile Phones with Gaseous Sensors for Environment Monitoring**

During the various agricultural processes, a number of gases are released into the atmosphere which might contribute to the global warming. For instance it might be necessary to measure the level of carbon monoxide which is responsible for the depletion of ozone layer and affecting the human life. If the gaseous monitoring sensors are interfaced with the mobile phones carried by the farmers, it can become one of the efficient ways to measure the gaseous emissions from the agricultural fields. Further, with appropriate geo-tagging using the GPS Sensors on the Mobile phones, the emissions can be represented on spatio-temporal graphs for better visualisation to study its effects to the environment.

Monitoring gaseous emission from plant can also play a significant role in detection of various stages of plant as well as plant diseases. Ethylene emission occurs during different stages of plant growth like fruit ripening, flower pollination etc. Some pathogen can also produce ethylene. So, when these pathogen interacts with host, there is drastic increase in ethylene emission. So it is necessary to monitor these ethylene levels to know severity of pest/disease.

**GPS and Acceleration sensors**

In Mobile Sensing based Agricultural Activity Detection project (Sharma et al., 2013) at TCS Innovation Labs Mumbai, we propose to use GPS and Acceleration Sensors data captured from the mobile phones carried by the farm workers to detect the various activities being carried out. Hence activities like sowing, irrigation, harvesting, bed making, etc. get recorded in the data base automatically and in real time. This information helps to provide right farming practices to the farmers at the right time. The view of farming history carried out at a particular farm level also assists an expert to provide more accurate agro-advisory services.

The other applications of GPS sensor would be in closely monitoring the farm to record various events like plant growth, disease attacks, in-appropriate irrigation due to undulating land and so on.

**Mobile Phone Based Spectrometer**

Visible region of electromagnetic spectrum has its importance in detection of chlorophyll content in vegetation as it contains wavelengths sensitive to chlorophyll. Specifically, the reflectance of the plant in the green and red region of the wavelength gives information about the chlorophyll content present in the plant which represents the plant health. Although Spectrometers are too expensive but in future inexpensive mobile phone based spectrometers could be used to monitor the chlorophyll contents. In addition to this by studying the spectral signature of the leaves given by the mobile based spectrometer, it might be to find out pest/disease attack on the plant.

**Conclusion**

From the present scenario of Indian agriculture, it is essential to adopt the Information, Communication and Mobile Sensing Technologies which lead to enhances the agricultural productivity to meet the demands of growing population. These technologies can help the farmers by disseminating the right information in timely manner related to crop scheduling, water management, pest/disease management, market linkage etc. It is necessary to train the farmers in order to change their mindset to adopt the available ICT technologies for sustainable agriculture.

**References**


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Introduction
India is an agricultural nation. Gross domestic product (GDP) of agriculture sector alone is 15% in 2012-13. Due to significantly improved speed and quality of services of ICT, the percentage GDP is increased 7.8 % in agriculture (i.e. 4.9 % in 1990-91 to 12.7 % in 2010-11) compared to other modular sectors. India stands prominent among all nations in the production of milk, pulses and jute. India is leading when it comes to cultivation of spices, plantation crops, livestock, fisheries and poultry. The stakes of fruits and vegetables have taken a leap far more than traditional crops in the past few years. Considering the phenomenal changes in recent years, this segment of agriculture would drive great growth by the adaptation of proposed models from ICT studies. ICT is much useful in the development of the agricultural sectors in promising manner. Some of the ICT applications are as proposed in the following points.

• Crop Management: Using pest management detection of insect has been done, wireless sensor network is used for irrigation and weed detection is used for crop assessment using remote sensing.

• Fruits quality inspection, sorting and grading: To improve and maintain the quality of fruits and vegetables and for Classification of agricultural products, image processing and machine learning is used.

• Identification of disease and plant content: Disease and various content of plants have been identified from leaves and skin of product using image processing algorithms.

• Crop and land estimation and Object tracking: Geographic information System(GIS), colour and texture segmentation algorithms are used.

Fruit Sorting
Farmers and distributors do conventional quality inspection and handpicking to sort and grade agricultural and food products. This manual method is time-consuming, laborious, less efficient, monotonous, slow and inconsistent. Using ICT technique like image processing, computer vision and machine learning, cost effective, consistent, greater product stability, safety, superior speed and accurate sorting can be achieved. Automatic fruit sorting can improve the quality of the product, abolish inconsistent manual evaluation, and reduce dependence on available traditional inspection. Quality sorting is based on a multitude of measures like flavor such as sweetness, acidity content in the product, grading through appearance on bases color, size, shape, blemishes and glossiness of product, and texture that is assorted on its firmness or product’s mouth feel. Below tables summarize some of the very recent grading and sorting systems.

Computer vision systems provide rapid, economic, hygienic, consistent and objective assessment. Difficulties still exist in this field due to relativity slow commercial uptake of computer vision technology and processing speeds still fail to meet modern manufacturing requirements in all sectors. A model for sorting is proposed in order to overcome drawback of current grading systems which are,

• Current sorting systems are not accurate (max. accuracy achieved 95%)

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<td></td>
<td>Color and FD</td>
<td>85.19%</td>
<td>Hong Zheng and Hongfei Lus, 2012</td>
</tr>
<tr>
<td>Strawberry</td>
<td>Size, shape and color</td>
<td>88.8%</td>
<td>Xu Liming and Zhao Yanchao, 2010</td>
</tr>
<tr>
<td>Date</td>
<td>Flabbiness, size, shape, intensity and defects</td>
<td>80%</td>
<td>Yousef Al Ohali, 2011</td>
</tr>
<tr>
<td>Cherries</td>
<td>Color</td>
<td>High</td>
<td>Qi Wang, 2012</td>
</tr>
<tr>
<td>Orange</td>
<td>Intensity and color</td>
<td>80%</td>
<td>F Juste and F Sevilla, 1991</td>
</tr>
<tr>
<td>Lemon</td>
<td>Color and size</td>
<td>94.04%</td>
<td>M Khojastehnazhand et al., 2010</td>
</tr>
<tr>
<td>Fruit*</td>
<td>Color, shape and size</td>
<td>90%</td>
<td>Woo Chaw Seng and Seyed Haldi, 2009</td>
</tr>
<tr>
<td></td>
<td>Shape and size</td>
<td>90%</td>
<td>Mustafa et al., 2009</td>
</tr>
<tr>
<td></td>
<td>Size</td>
<td>High</td>
<td>Hongshe Dang et al., 2010</td>
</tr>
</tbody>
</table>

* Generalized algorithm for all fruits
• Very few parameters like size and color are considered for grading systems
• Still all are under research laboratories
• Most of research and development of automated agriculture product sorting has been done outside India
• The sorting of fruits is still performed manually in India
• No grading system is yet available for fruits like chikoo, sugarcane and grapes etc that are exported to other countries from India

Proposed Model
As shown in figure, firstly fruits are collected in a chamber. From the chamber it moves through escalators safely where the weight of the fruit gets estimated. It moves towards another chamber where the image of fruit is captured by more than one camera in different angle. For detecting fruit growth (raw or ripped), smell of the fruit is detected by sensors of wireless sensor network. Image is then processed where various algorithms are applied on image for finding expected features like size, depth, 3D model, texture and color.

For finding different features of fruit image following steps should be applied,
1. Image segmentation algorithm can be applied on captured image. Histogram thresholding, feature space clustering, Region based approach; Edge detection approach, fuzzy approach and neural network approach are the examples of segmentation methods.
2. From the segmented image, size parameter can be identified using machine vision by measuring projected area, perimeter or diameter.
3. Shape feature can be identified using contour based methods like chain code, B-spine, Hausdorff distance, Fourier descriptor, etc. or region based methods like convex hull, medial axis, Legendre moments, shape matrix etc.
4. On moving up to next, color feature can be identified using color features of fruits and vegetables included mean, variance, ranges of the red, green, and blue color primaries (RGB color model) and the derived hue, saturation, and intensity values (HSI color model).
5. Skin disease and defects can be found out using skin texture identification methods.
6. Image descriptors like global color histogram; Unser’s descriptors, color coherence vectors, border/interior, appearance descriptors etc. can be used for classification of fruits and vegetables. (e.g. Mango can be Kesar, Alus, Rajapuri etc.)
7. Finally, machine-learning algorithm is used for classification of parameters. Machine learning algorithms are neural network, fuzzy logic, genetic algorithm, fractal dimensions, Support Vector Machine (SVM), K- Nearest Neighbor (KNN), Linear Discriminant Analysis (LDA) etc. Based on the decision drawn after the process on the above steps, the fruit is classified into different categories like big, small, medium sized, ripe/unripe or defectives. Finally automatic packaging system packs the fruit according to the categories provided.
Conclusion and Future Direction
Automated fruit sorting is speedy, inexpensive, safe and accurate. Proposed model is generalized and it is considering far more feature parameters than available sorting systems. Currently, research in the automated fruit sorting and grading has been conducted by experimenting them in laboratories only. So a properly focused research and a detailed review on this research area need to be carried out.

References

About the Authors
Sapan Naik received his Bachelor degree in 2007 from Dharmsinh Desai University, India. He received his master degree in field of Computer engineering in 2012 from Gujarat Technological University. He is working as Asst. professor at Shrimad Rajchandra Institute of Management and Computer Application, Uka Tarsadia University, Bardoli, India. His research interest includes Image Processing and machine learning. He has published eight papers at national and international level. He is currently pursuing his Ph.D. on “Smart Farming by Image Processing and Machine Learning” at Uka Tarsadia University.

Bankim Patel is Ph.D. and he has 20 years of teaching and 17 years of research experience. His area of interest is Natural Language Processing and Intelligent Systems. Under his guidance 7 research scholar have finished their Ph.D. and 2 have finished M.Phil. He is the Director of Shrimad Rajchandra Institute of Management and Computer application. He has received many awards like Significant contribution award in 2008-09 by Computer Society of India, Vikas Rattan in 2005, Jewel of India in 2005 and many more.
Article

ICT Enabled Agriculture Transforming India

Agriculture is most important sector with the majority of the rural population in developing countries depending on it. In Indian scenario, it said that the country lives in villages which means that farming and agriculture sector contributes in GDP of the country to great extent. The traditional approaches of agriculture being adopted since long back in the history, has numerous challenges in terms of production, marketing, profit etc. The management of agricultural products, choice of suitable seeds and the suitable amount of fertilizers are some of other issues that need attention in order to enhance the production and sustainable development. If the agriculture sector performs well then only we can think of India marching ahead towards becoming developed nation due to economical autonomy.

The challenges of the traditional agriculture are addressed significantly by using information and communication technologies (ICT) that play an important role in uplifting the livelihoods of the rural poor. This article explores the role of ICT in agricultural sector in India and transforming the country through increased growth and sustainable production of agricultural products.

Introduction

Current literatures suggest that the agriculture is a source of livelihoods for 86% of rural people in India and it provides 1.3 billion jobs for small-scale farmers and landless workers. Moreover, the contribution of agriculture in growth of GDP in much more as compared to other sectors. In recent years, with the advent of ICT tools, potential contribution of ICT can be seen in achieving agricultural development objectives and contributing to broader economic, social and institutional development. ICT helps in growing demand for new approaches, business models, good practices and design guidance in agriculture and rural development projects. Lot assistance is available for the farmers with the use of ICT. The proper awareness and understanding about crops, seeds, fertilizers, marketing and other related information, are achieved through several media using ICT tools. ICT also helps in empowering the poor and rural people by providing better access to natural resources, improved agricultural technologies, effective production strategies, markets, banking and financial services; local and national policies related to agriculture etc.

Objectives

ICT in agriculture sector meets several objectives and thereby achieving agricultural growth, rural employment, enhanced productivity and happy livelihood. Following are some of the main objectives of ICT enabled agriculture:

• To ensure ownership and develop entrepreneurship in farmers of Indian villages.
• To develop local content and create awareness.
• To spread knowledge of technologies, crop cycle, suitable use of fertilizers etc.
• To ensure language and cultural pertinence and active participation of farmers.
• To help the villagers augment the growth of agriculture and contribute in GDP growth.
• To implement a framework for agricultural development strategies, investments and programs.
• To provide concrete guidance on agriculture through several motivational real time examples; telling them the success stories of farmers who have been successful using ICT.
• To increase public investment in agriculture.
• To provide local as well as global markets.
• To improve access to financial and banking services.
• To improve performance of producer organizations.
• To use innovative practices through science and technology, and many more....

Scope of ICT

It has been acknowledged by various reports of government that application of ICTs at the different levels of agricultural processes result in improvements of agricultural competitiveness. Management of technological information which includes price and market information; weather conditions; economic variables; communication with peers and business transactions etc., plays a significant role in achieving competitiveness. ICTs provide transparency in implementation mechanisms that could be seen in paddy procurement systems of government of Chhattisgarh state, and several other purchase schemes of various crops all across the country. The money is directly transferred to bank account of farmers that reduces the possibility of malpractices by agents and also addresses the corruption menace to large extent.

The department of weather forecasting predicts about rain and weather in general, helps the farmers in planning managing of various stages of agriculture. ICT plays crucial role in agriculture production, crop management and others, however, the implementation is affected by several factors such as: required infrastructure for access and affordability of ICT tools and facilities; internet connectivity in production and commercial areas; outreach of awareness programmes, the quality and availability of suitable information content; limitation of the media; choices and appropriation of individuals towards ICT based approaches etc.

Land Management and Planning

Lot of time is wasted in completing the formalities related to updating of land records that are required in order to avail government benefits and schemes. So, the difficulty of land management and planning; and getting their documents ready for availing benefit of several schemes; ICT plays an important role. With the help of government personnel, the farmers are guided how to get their work done related to land records. They can avail lot of advantages of the schemes through mobile phones since the telephone has also greatly helped in transforming and creating revolutions in villages also. Geographic Information Systems (GIS) and Remote Sensing (RS) techniques are used as important keys assisting ICT solutions for land planning and management. GIS helps cater multiple...
layers of information, drawn from different sources, into one spatial representation. There is great potential of use of mobile phones to push information on climate friendly agriculture to farmers. Large amount of suitable and relevant data can be collected and made available to farmers related to soil information and others. Mobile technology gives opportunity better and efficient mechanism to farmers and purchasers of their crops.

**Green and Environmental Friendly Growth**

Agricultural progress and subsequent increased production are very important advantages of ICT enabled agriculture. However, environmental issues need to be taken care of so that the harmful effect of augmented crop production and marketing could not affect the society and mankind. Climate change and green growth are always to be at top agricultural development agenda. Agricultural productivity should not be achieved at the cost of environmental adverse effects. Actually, limited resources, population growth and environmental concerns are some of the challenges in augmenting the agricultural productivity; and this could further be affected if there is adverse effect. Therefore, ICT usage should take care of these issues. In many developing countries including India, farmers determine fertilizer usage and its amount with the help of retailers, but its automated and calculated implementation is required to improve the productivity that is made possible using ICT tools. Use of ICT is required for innovation in assessment and management of agriculture’s impact on the environment, water and other natural resources.

**Outcome**

ICT has helped agriculture sector to great extent that further making livelihood of rural people better; finally the services are of big importance for the nation since GDP of the country is controlled by agriculture. Following are some major outcomes of ICT enabled agriculture:

- Increased productivity due to growth and penetration of mobile ICTs in rural areas.
- Innovations in agriculture through electronic media that supports education and training.
- Creation of new opportunities increasing the development of human and social capital.
- Achieving improved process control, transparency in market information.
- Reduction of transaction costs in tracking of consumer needs.
- Enhanced food security and support rural to livelihoods.
- Poverty alleviation through modern agriculture.
- Expansion of perspective of local communities in terms of national or global developments.
- Creation of new business opportunities.

The above outcome can be seen in various ICT based agricultural implementations by several government agencies. Few of them are ‘e-krishi’, ‘kheti’ project etc.

**Challenges**

The use of ICTs in most of agricultural implementations is gaining importance but there are some challenges in implementation of ICT based services that need attention and requires a lot of research. Following are major challenges:

- Lack of access to ICT tools.
- Lack of understanding and awareness of the needs and challenges of small scale farmers
- Lack of standardized approaches of ICT usage in national poverty reduction schemes.
- Need of appropriate socio cultural issues to achieve the desired objectives.
- Poor connectivity, low bandwidth, limited electricity, user driven information.

**References**


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ICTs intervention in Indian Agriculture

Introduction

In 21st century Agriculture continues to be the key sector to provide foundation for sustainability of millions of Indian farmer families. Agriculture trade and promising needs are bringing changes rapidly towards the new extension system to meet new challenges emerging. The whole new scenario demands inducting reforms process to bring out changes in systems, processes, frameworks and policies. Innovations play an important role in Agriculture for optimising resources utilisation by farmers. The new way of learning in terms of local context, operational process, need-based, user-centric and in-time extension services system provided an innovation challenge to all the stakeholders in it. The general recommendations of erstwhile system were replaced with localised or/and situation specific advises as per field situation vary from place to place in India. The relevant, understandable and need based information available timely in local language and reach in time enhance the farm productivity. A series of manageable technological interventions are possible near to the farmers once social capital is in place over which managerial decision making capacity is going to be built. The resource poor and disadvantage farmer become competitive by efficient and effective in time-managed knowledge while combining social capital with economic capital resources. In this context, other modes of reaching out to the farmers such as mass media, ICT connectivity were highlighted. By broad based technology dissemination process and improve the economics of scale in accessing input, credit, market, monsoon, in-time advise and so on this would also improve the performance of agricultural technology system.

The policy makers and development practitioners concentrate in every plan to reduce the drawbacks to reach the needy farmers but fail. To create a chance for economic growth, social empowerment and grassroots innovation in Agricultural supply chain to millions of farmers Information and Communication Technologies (ICTs) are playing decisive role. Slowly reducing mass media, but embracing and usage of Mobile phone/Internet based systems (including kiosks) provide a chance to distribute information quicker and useful to the farmers (see Table-1). Every ICT has its own strengths and weaknesses in functionality, implementation & delivery of services to needy end-users. The use and selection of information from different sources depends on: cost, accuracy, reliability, convenience of access, usefulness, the format, at time, and past success.

We see the agriculture supply chain has a shift towards ‘producing for market’ from ’marketing of the produce’. This shift not only brings technology adoption for transfer of (need/time/localised/crop/ market based) knowledge/information that the farmer has to make a decision at every point. The tendency of farmers is to produce and market, if they are excess. The profitability achieved from surplus marketed encourage farmer to develop and strengthen into an entrepreneur. The value addition at farmer side surely enhances income of farmer but it is difficult in normal public extension system. A favourable solution through ICT intervened advisory and knowledge services using innovative business models incorporated into projects lead towards a modified extension system.

ICT Initiatives in Indian Agriculture

Agriculture extension is highly dependent on the flow of information among farmers and with experts in the area concerned. But the availability of extension services to farmers is very small due to reach and availability of experts across zones. The embracing of technology or knowledge or information happens through the stages awareness, interest, information, trail and then adoption. It creates confidence, trust and belief on the intervention to the farmer. For this reason, ICTs can have a significant impact on extension. ICTs can cover services in more villages and more farmers in different local languages at the same time. Supply of critical inputs along with farm information and advisory services can demand a cost sharing payment with farmers that they ready to agree. For any intervention the major forces are technology, market force, capacity of organisation and telecom service provider to make an ICT case sustainable at long run. A shared role in public-private partnership with assured mode of interdependence for the sake of farming community lead to such ICT initiatives.

Any pilot ICT project succeeded in one state has to customise again to scale for each state. It needs to adopt a dynamic business model and a flexible ICT technology to implement and sustain in long run. Most of the ICT projects adopt a dynamic business model that suit well to the needs of its set objectives as per users/consumers interests. The technology adopted mostly in all cases is based on kiosks and later mobile phones. The shift in technology medium is due to availability, spread, reach, usage, and affordable to rural areas. The mobile phone connectivity has reached across India, which is the strength for projects implementation. The reach and connectivity are major hurdles in extension, but crossed the barriers with such technology interventions. Literacy, affordability, language, localised, crop specific, agro climatic specific, consumer confidence based services bring new challenges to technologists, agriculture scientists, social scientists, managers and service providers mainly.

Mobiles in Agriculture

Mobile phone based innovations are quickly emerging as the new frontier for transforming government, agriculture, health, banking, education and many other sectors due to the fast growing penetration of mobiles even to the poorest and remotest areas of the globe. Innovative business models, which focus on promoting economic development and helping low-income communities to improve, are creating ground for firms in new emerging markets. The firms act as powerful catalysts for market-led socio economic development of rural areas. Some of these business initiatives are new/creative and are of interest to researchers and other business communities. Such a scenario is an example of knowledge economy, which is characterized by a shift from the routine production of goods towards the creation of ideas for the...
benefit of all stakeholders. Technology is leading the advantage for the benefit of agriculture and rural development domain by its features bringing firms towards this. A promising convergence technology penetrating across the globe, irrespective of per-capita, region, race, gender and age is the same telecommunication tool – the mobile phone. It can be a delivery channel for all media and Internet, from point to point (sender to receiver) or to many points and from multiple points to any number of receiver points. Convergence has enabled content providers to create and deliver knowledge products in digital form to the needy numerous consumers at any time and space scales. It eliminates the existing weaknesses, simplifies the steps of production and diversifies distribution in the knowledge supply chain. Through mobiles, many public and private services have now reached poor households and communities as demand for mobile applications raise. As per Hudson, telecommunications, as a means of sharing information, is not simply a connection between people, but a link in the chain of the development process itself.

Table 1: Delivery of services to farmers

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of ICT</th>
<th>Functionality</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Kiosk-CSCs</td>
<td>Available on individual/community basis</td>
<td>• Best for community services&lt;br&gt;• Best for pull based services&lt;br&gt;• Best for local language based content&lt;br&gt;• Best for store, repeat and re-use of content&lt;br&gt;• Can create local knowledge depository&lt;br&gt;• Multiple ICT features can be used for better extension&lt;br&gt;• Can be used for multiple areas&lt;br&gt;• ROI is high at proper usage&lt;br&gt;• Multiple services are in use&lt;br&gt;• Better for eGovernance running</td>
<td>• Operator need is essential&lt;br&gt;• Reach to any individual is difficult&lt;br&gt;• Individual push based service is difficult to implement&lt;br&gt;• All can’t be able to utilise by themselves&lt;br&gt;• Availability of services is time-bound&lt;br&gt;• Establishment cost is to be born by system&lt;br&gt;• Power supply, back-up and maintenance are critical&lt;br&gt;• Recurring cost is high at low usage&lt;br&gt;• Skills for usage is needed for operators</td>
</tr>
<tr>
<td>02</td>
<td>Mobile Phone</td>
<td>Availability on individual basis</td>
<td>• Best for user specific services&lt;br&gt;• Reach is definite at any time &amp; space to any one / many&lt;br&gt;• Best in speed, accuracy, transparency, equal info-delivery at low or no cost&lt;br&gt;• Best for text or voice based SMS services&lt;br&gt;• Best in video stream under 3G&lt;br&gt;• Service available for 24x7&lt;br&gt;• Best to provide information at farmer’s understandable level&lt;br&gt;• Radio, Internet, Video streaming etc are added features add value</td>
<td>• The display space &amp; font language display are device dependent&lt;br&gt;• Most of the farmers use low end devices that has limited features&lt;br&gt;• Voice &amp; text SMS are difficult to store&lt;br&gt;• User specific service can only succeed&lt;br&gt;• The SMS within 256 characters &amp; voice in 03-minutes are the restriction&lt;br&gt;• Multiple SMSs won’t have impact on farmers</td>
</tr>
<tr>
<td>03</td>
<td>Community Radio</td>
<td>Available on community basis</td>
<td>• Best for localised information dissemination&lt;br&gt;• Participatory programs enhance local community development&lt;br&gt;• Best for training &amp; message delivery at pre-fixed time to all&lt;br&gt;• Own &amp; local problems are discussed in their own dialect&lt;br&gt;• Interaction with nearby progressive farmer help adoption of skills &amp; knowledge&lt;br&gt;• Mobile phone based FM community radio is best option&lt;br&gt;• Phone-in is the best interactivity with any expert or progressive farmer</td>
<td>• Community radio require radio to listen&lt;br&gt;• The cost in terms of batteries or electricity&lt;br&gt;• Radio is cost to buy for usage&lt;br&gt;• Better (static) spring winding radios are not available in market now&lt;br&gt;• It is a one way linkage with voice connectivity&lt;br&gt;• Field demonstrations can’t be seen like in television&lt;br&gt;• Till visual radio launch it still provide restricted community support</td>
</tr>
</tbody>
</table>

Fig. 1: Rural information services
Mobile Applications and Services Initiatives

To bridge the information gap between the farmers and to build a productive and competitive agriculture system, different ICT interventions made rural and under-developed markets become efficient and productive. Farmer friendly and cost-effective solutions tailored to the needs of farmers have created new channels to communicate through mobile technologies in a well-connected way by space and time. With rapid technological developments, the mobile phone has evolved from a ‘mere communication device’ to a ‘smart phone’ with an ability to tap a surplus of information and services. The adoption of services depend on one criteria is ‘affordability’ to have device cost and service charge. The customer needs are addressed by: easy access to services, motivating users to adopt the services and understanding the service competency. The basic services have evolved rapidly. As per Davis TAM, five attributes contributed towards adoption of services: ease of use, usefulness, attitude towards use, intention to use and actual use.

Having a mobile doesn’t improve livelihood of a farmer but when it is associated with learning agriculture techniques and tools, easier access to required/timely information and knowing in advance produce prices in local market(s) become really valuable. Most of the pilot projects in the developing world show well that mobiles can play a role reaching through services to rural populations. Tailor made services in a local language with local content based on mobiles is not an easy task. It provides good benefits to information hungry rural consumers at an affordable cost. The key to such services success is depends on consumer demands and how they delivered. Providing new services faster without confusing data leads to consumer satisfaction. Mobile devices are becoming increasingly affordable, provide connectivity to more people and also offer better interactivity than other ICT devices.

There is very high potential in usage of ICTs for agricultural development. The four ICT innovative projects considered shown here are exclusively for agricultural development. They are eSagu, Agrocom, RML and mKrishi projects are quite different in scale and implementation of delivery, but look with the objective of improving the delivery of information to farmers. Every project built on a business model with related ICT technology adoption but their goal is to build services for farmers’ socio economic development. It provides a chance for initiators to be innovative in delivery of services by adopting mobile technology with various applications as seen in Table-2.

Local, customised and crucial services are critical with constant updates and trends are provided. These projects are implemented keeping in mind the transparency, operational range and

Table-2: Delivery of services to farmers

<table>
<thead>
<tr>
<th>Concept</th>
<th>eSagu</th>
<th>Agrocom</th>
<th>RML</th>
<th>mKrishi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service provision: on-request, on-demand, crop stage &amp; time</td>
<td>On-demand (Full crop cycle)</td>
<td>On-request &amp; at pre-fixed time</td>
<td>On-request &amp; at pre-fixed time</td>
<td>On-request &amp; at pre-fixed time</td>
</tr>
<tr>
<td>Push and Pull based</td>
<td>Semi</td>
<td>Pull based</td>
<td>Push based</td>
<td>Pull based</td>
</tr>
<tr>
<td>Paid service: registration, pre-paid, specific duration, crop specific, service specific</td>
<td>No (Academic research)</td>
<td>Pre-paid (Crop &amp; duration)</td>
<td>Yes (Monthly &amp; crop)</td>
<td>Yes (Monthly &amp; EMI based)</td>
</tr>
<tr>
<td>Local, customised &amp; crucial services</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Interaction with farmers: daily, weekly, fortnightly, monthly</td>
<td>Need based (weekly)</td>
<td>Daily or as per data delivery</td>
<td>Daily (Twice through SMS)</td>
<td>As per need of farmer request</td>
</tr>
<tr>
<td>Micro-weather Service (temp, weather, cloud cover) &amp; Information (village/region/cluster)</td>
<td>Yes (Village based as per need)</td>
<td>Yes (Village/cluster based)</td>
<td>Yes (Daily village based)</td>
<td>Yes (Daily village based)</td>
</tr>
<tr>
<td>Updates, trends &amp; add-on services</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Training &amp; support to services: self or third party</td>
<td>Yes</td>
<td>No (online)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Expert recommendation</td>
<td>Zone specific: Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Local language: Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Time bound: Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Crop specific: Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Farmer specific: Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Production history based: Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
efficiency/scaling issues in mind. Such services provide benefits to farmers as seen in Table-3.

**Conclusion**

When it comes to identifying which ICT device can provide the best method of delivering public services, mobile phones lead with the best potential for stimulating the supply and demand of public services. The ICT based applications and services particularly by providing access to information, price of produce & inputs from nearby markets, technology transfer and other extension functions lead to better socio economic development of farmer community. ICTs are acting as info delivery catalyst for better livelihood of rural areas. The better results are going to be seen once the services reach across rather some pockets of the country. Coordination and cooperation to deliver mobile services in Agriculture can provide for the future sustainability of such initiatives.

**References**


**Table 3: Benefits from services**

<table>
<thead>
<tr>
<th>Concept</th>
<th>eSagu</th>
<th>Agrocom</th>
<th>RML</th>
<th>mKrishi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer needs met</td>
<td>Yes</td>
<td></td>
<td>Some what</td>
<td>Yes with limitations</td>
</tr>
<tr>
<td>Relevant to farmer needs</td>
<td>Yes</td>
<td>Almost</td>
<td>Yes</td>
<td>Some what</td>
</tr>
<tr>
<td>Enhance farmer income:</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>measurable system built-in or not</td>
<td>(No- but suggested)</td>
<td>(Not built-in)</td>
<td>(Not built-in)</td>
<td></td>
</tr>
<tr>
<td>Upto date, localised &amp; customised</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Raise productivity &amp; revenue</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>(Measurable)</td>
<td></td>
<td></td>
<td></td>
<td>(Partially can measure)</td>
</tr>
</tbody>
</table>

Kasina V. Rao is a doctoral student working under Prof. R M Sonar, SJMSOM and Prof. Krithi Ramamritham, CSE on “ICTs for Development (ICT4D)” area in general but specific on “Mobiles for Development (M4D)” at SJM School of Management, Indian Institute of Technology Bombay. Submitted thesis titled “Evaluating socio economic impact of mobile services intervention in rural areas” for final review.
In the last issue, we familiarized with the techniques on how to run an R script. Now let us look at the features that support basic programming in R. In this issue, we will discuss the operators and control structures used in R programs.

Operators in R

As in all other languages, R also has a bunch of operators. R provides operators for mathematical operations, modulus, exponent, function calls, grouping expressions, comparison, assignment etc. A list of operators in R and its description is given in Table 1 in the order of their decreasing precedence. If operators of equal precedence are occurring in the same line, then they are evaluated from left to right.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( or {</td>
<td>Function calls or grouping expressions</td>
</tr>
<tr>
<td>] or []</td>
<td>Subscripting or subsetting</td>
</tr>
<tr>
<td>:: or ::</td>
<td>Namespace access</td>
</tr>
<tr>
<td>$ or @</td>
<td>Component extraction</td>
</tr>
<tr>
<td>^</td>
<td>Exponentiation</td>
</tr>
<tr>
<td>+, -</td>
<td>Unary plus and minus</td>
</tr>
<tr>
<td>:</td>
<td>Sequence operator</td>
</tr>
<tr>
<td>*, /</td>
<td>Multiply and divide</td>
</tr>
<tr>
<td>+, -</td>
<td>Binary addition and subtraction</td>
</tr>
<tr>
<td>&lt;&gt;, &lt;=, &gt;=, ==, !=</td>
<td>Comparison</td>
</tr>
<tr>
<td>!</td>
<td>Negation</td>
</tr>
<tr>
<td>&amp;</td>
<td>AND</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>=, = &gt;</td>
<td>Define formula</td>
</tr>
<tr>
<td>=, = &lt;</td>
<td>Left assignment</td>
</tr>
<tr>
<td>?</td>
<td>help</td>
</tr>
</tbody>
</table>

Table 1: Operators in R

Control Structures

R provides conditional statements and iterative statements to regulate the flow of the program. Conditional statements (if, ifelse, switch etc.) evaluate a particular condition and if it is evaluated TRUE, then the corresponding expressions or actions will be executed. Iterative statements (for, while, repeat, etc.), evaluate expressions repeatedly until its corresponding condition become FALSE.

(a) if...else

if...else is one of the commonly used conditional statement in many programming languages. The general structure of this statement is if (condition) {
  Expression set1
} else {
  Expression set2
}

Here the condition given within the if- clause is evaluated first and if it is TRUE then the expression set1 is executed. Otherwise, the expression set2 is executed. The else part is optional.

A simple example is given below. See the script saved in the R editor and its output appeared in the R console.

(b) ifelse

Another conditional statement in R is ifelse. The syntax for ifelse is ifelse(condition, expression1, expression2)

Here if the condition is evaluated TRUE, then expression1 will be executed and if it is evaluated FALSE then expression2 will be executed. See the example given below:

```r
>x = 1:10  # Creates sample data
>ifelse(x<5 | x>8, x, 0)
[1]  1  2  3  4  0  0  0  0  9 10
```

(c) switch

switch allows multiway branching. Using switch statement, multiple statements are evaluated for a given expression and the statement corresponding to the expression is executed. The syntax for switch in R is different from other common programming languages.

switch (expression, list)

Here, the first argument to switch is the expression whose value is used for program control. The second argument is list of statements among which one will be executed based on the given expression. If the expression is numeric then the statement corresponding to that number is executed and result will be returned. If the expression is a character/string then the list item with the matching name is chosen and the corresponding list value will be returned.

Some simple examples for switch statement for both numeric and character/string expressions are given below:

So hope you all got a clear idea on the conditional statements used in R and how they control the program flow of R scripts. In the coming issue we will discuss how the iterative statements are used in R scripts for regulating the program flow. Have a nice time ahead!
IT Industry Perspective

Interview with Achyut Godbole

Achyut Godbole has made significant contribution for the multifold growth of companies such as Patni, Syntel, L & T Infotech, Apar and Disha etc while working at the highest level. During his illustrious career and 32 years of experience with software companies he has traveled all over the globe more than 150 times for IT business. He stood 16th in the SSC exams and 1st in the University and is a Chemical Engineer from IIT Mumbai.

He has written books on: ‘Operating Systems’, ‘Data Communications and Networks’, ‘Web Technologies’ and ‘Demystifying Computers’ published by Tata-McGraw-Hill and used as textbooks worldwide. Many are written in different languages such as Chinese. He is a very popular author in Marathi as well and has written numerous Marathi books, which are best sellers with several editions coming out in a very short time. Currently many of his new books are in the pipeline.

He has keen interest in Music, Literature, Economics, Science, Mathematics, Climate Science, Management and Psychology apart from Information Technology. He was awarded a very prestigious ‘Distinguished Aluminus’ by IIT, ‘Udyogratna’, twice by the prime minister for excellent performance of his company, ‘Kumar Gandharva Award’ by Pandit Bhimsen Joshi, ‘Sahyadri Navratna’, ‘Indradhanu’ awards, ‘Dr. Parnerkar Award’ for contribution to Economics, Maharashtra State Awards to Nadvedh, Kimyagar, ArtChat, Nanoday and Manat, Marathi Sahitya Parishad Award to ‘Manat’, N.C. Kelkar Award to Nanoday and ‘The Scholar of the year’ award by Wadia College Pune.

He was President of Yuva-Natyta Sahitya Sammelan held in 2011 and has contributed to building ‘Ashiana’ - a school in Mumbai for mentally challenged children with about 40 autistic children. He worked with Bhill adivasis at Shahada Taluka, Dhulia District after passing out from IIT. Currently, he is the Managing Director of ‘Softexcel Consultancy Services’. He can be contacted at achyut.godbole@gmail.com, godboleas@yahoo.com and at his website: http://achyutgodbole.com/

It is a pleasure to present here his thoughts on IT industry in the form of an interview.

Q1. How has IT industry in India changed over the last 30 – 40 years or so as per your experience and the way you have witnessed this change while managing IT companies?

Ans: We can talk of IT era in terms of 5 decades /epochs - 1960s was an epoch of mainframes, 1970s of minicomputers, 1980s of personal computers, 1990s of satellite links and Internet and 2000 onwards – an epoch when allied businesses like BPO, call centres etc. emerged. In 1960s and early 1970s mainframe computers were used for backend processing which essentially was batch processing. Punched cards were used for these computers, which were not user friendly at all. Multimedia, colours and GUI were absent in that era and common people found it difficult to use the computers. Computers were mainly used for storing large databases and only large companies used them. 1970s saw minicomputers emerge and costs and sizes fell, though the computing power increased manifolds. Companies like HP, Wang, DEC, Data General etc. came up. Various databases and proprietary networks emerged, but computers still remained beyond the reach of common public.

1980s brought about a major change. It is now that the computers became much smaller, faster and cheaper. Many people could afford them and that changed the entire scenario. Colourful screens, multimedia, GUI etc started emerging and computers started becoming easy to use for common people. They were seen on the desktops of many managers, officers, doctors, lawyers and also in many homes. People for the first time started trusting computers.

Earlier, Information Technology was following businesses. Computers were being used for ‘automating’ or ‘mimicking’ manual processes. And in fact, in batch processing there used to be delays in computer reports than in manual processes. With the advent of Personal Computers and networking, the entire scenario changed. Information Technology was now being used not only for improving the efficiency of business processes marginally, but radically, by throwing out the old processes completely and designing entirely new processes in their place. Now, IT went to businesses and started telling them ‘I shall not only follow or mimic you but will show you how you can do the same business differently and more efficiently’. This brought the concept of Business Process Re-engineering (BPR). E.g. ATMs in banks brought about a change in the way cash was deposited or dispensed. This was not done in an incremental way, but in a revolutionary way. Processes underwent radical changes and old processes started getting obliterated. The same thing happened in the case of animation, which was done differently earlier. CAD/CAM changed drafting and engineering design process completely. Word processing and DTP changed publishing industry completely and radically. It did not just increase the efficiency by a small margin. It changed the process completely. It was now that most of the companies in the US started using Information Technology like crazy to increase the efficiency of their businesses and to stay in competition. Till that time IT was peripheral. Now it became central for running any business. If General Motors did not use IT, but Chrysler used it efficiently, Chrysler would beat General Motors in competition. And if Chrysler did not use IT, but Ford used it, Ford would go ahead in competition.
Therefore, all companies started using IT in a big way. Thus IT became a necessity rather than luxury.

This created a tremendous demand of programmers. Demand surged in mid-1980s and Indian companies woke up to this new reality. I was in Patni at that time after Mr. Narayan Murthy had left and was occupying the same chair. We at Patni, Infosys, TCS, Wipro, Datamatics and a few other companies knew that there was tremendous demand in the US for good programmers, and we also knew that we could provide those to them. However, the challenge was to get to the customers. We used to go to the US and literally start cold calling prospective customers, sometimes using yellow pages. The rates that American contracting and consulting companies charged the American end users for American programmers were around 60 to 80 US dollars per hour. Our value proposition was that we would send programmers there and charge only 40 to 50 dollars per hour, which would take care of the cost of their air fair, hotel stay, their Indian salary for their family and our profit margin etc. We thought that due to the cost arbitrage, the American companies would ask for hundreds of our programmers. But they did not accept our proposition initially because of the huge credibility gap. India was perceived as a country of serpents, elephants and magicians. They just could not believe that India could have good computer programmers. I still remember that in New York, I used to start my presentations saying that India is full of serpents, elephants and magicians, but we still have good programmers and they would look at me with complete disbelief. India's image cherished in their mind was completely different then. So it was a very challenging period to convince customers. After a lot of requesting and begging, finally, one of them yielded or in fact, took pity on me. They were ready to try out our two software engineers with the promise of replacing them at our cost, should they not work out. The first two people were finally sent. I had selected the best and the brightest M. Tech. Computer Science guys. Obviously, they did the magic. After looking at their performance, the customer requested for two more and then two more and so on and so forth. Similar was the experience of all the Indian companies. Slowly credibility gap started getting bridged and then in the decade of 1980s, Indian Software companies sent more than 100,000 people to the US. That was basically 'onsite' work called disparagingly as 'body shopping'.

1990s was an era of satellite connectivity and of Internet. Earlier it was all onsite work. At this juncture, the Indian companies started pitching for the offshore projects. The customers by now were convinced about the Indian talent and the ability to carry out programming jobs. However, customers were not sure of our project management skills. This fear was compounded by the distance. It was one thing to execute a project under your nose but executing it thousands of miles away was quite different. Basically customers had the fear of delegating work to a company situated thousands of miles away. Their fear was genuine. If the project duration was of 6 months and the fear was what would happen if 5 months and 3 weeks down the line, the Indian company throws its hands up and says that the completion of the project would take another 3 months! The best the American company would do was to withhold the last payment of the Indian company. However, that was hardly any solace. The cost of attendant lost face and business from their customers in turn was far, far more. The question was of continuous monitoring of deadlines and quality from a distance of thousands of miles. But the satellite links changed the picture completely. When one depresses a key in Mumbai, now, the character appears on the screen in New York or it sits on the disk in New York. This helped the customer review my progress in real time. If I had promised to complete 10 programs by the weekend i.e. by Friday evening (which is Friday morning in New York), the customer could now check my programs immediately. Then there were several visits from both sides to talk about the project, its methodology and schedules etc. This helped tremendously to bridge the credibility gap. This was all possible due to the satellite links and networking. That's how slowly it all started and then in 1990s, huge offshore centres emerged in Mumbai, Pune, Chennai, Hyderabad, Delhi, Calcutta, Bangalore etc. Then Internet came, dot-com bubble happened and then came Y2K and after Y2K, people made huge progress, because many customers wanted to do Y2K work from India. Thus new avenues came up and Indian IT grew.

Q.2. IT industry in India is mainly service Industry. Recent annual report of Dept of Electronics and IT recognizes IT and ITES as services rendered by IT industry. Has there been change in the nature of services rendered over the years? There is not as much change as there should have been. Only difference now is that larger companies like TCS, Wipro, Infosys, Cognizant etc. have started giving high value services e.g. business analysis, technical architecture, total solutions and so on. Coding, testing and maintenance are still a large portion of the IT industry. However, some larger companies are providing higher value and higher level of services. It’s a good sign but this should further increase and that too, far more rapidly. It is certainly not up to the mark yet. Large companies are doing good job. But even today large portion of Indian IT industry is coding, testing and maintenance work, which is a kind of bread and butter for them. I am not saying that it should not continue. What I would like to suggest is that proportion of higher level of services and products needs to increase.

The main reason for this suggestion is that programming services can be replaced very easily. Everyone knows that China is good in hardware and we are good in software. Suppose tomorrow they (Chinese) train their millions of people in software and deliberately depress the rate - say 15 dollar an hour instead of 25 dollar an hour, just think what will happen to our IT business. It is a risk for our IT industry. But if we are providing high level of services, we can penetrate the customer better, it becomes difficult to replace our services and this in turn increases our stability. On the other hand, with only low-end services we are vulnerable to competition. Low-end services can be easily shifted to other countries like Indonesia, Eastern Europe or wherever competition arises from. Also we lack in products tremendously.

Q.3. How have changes in technology impacted the IT industry as such and IT industry in India to be specific? Has it made IT more like any other commodity?
As technology changed from mainframes to minicomputers and then to desktops, satellite links, networks and Internet, role of IT in industry went on changing and simultaneously it impacted our own IT industry. I already spoke about this in detail while talking about various epochs of IT industry that I have been witness to. These epochs are mainly due to change in technology and its impact on the industry. I don’t know whether this answers the question or not, but I sincerely think that so far as India is concerned, actually IT should be used for Indian economy, Indian society, which we use far less. Even today when we go to any government office, we find that there are large piles of paper files. Actually we should be doing entire process using information technology. We should be using IT for education, healthcare, agriculture, weather forecasting, farmer’s education for instance. Lot of areas where IT can be used are still not touched. We are completely focused on export. But that is actually a vulnerability of our IT industry. Today dollar rate is good, which is giving good profitability to IT companies. What if the rate comes down tomorrow? All profitability will go down.

**Q.4. Do you really think that India is software super power as is perceived sometimes? E.g. in the book World is Flat, author Friedman writes about a child talking about India as a country from where their software comes... I do not at all think that India is a software super power. Only 0.25% of our population is in IT and they do coding, testing and maintenance work for some American companies. That is not exactly a description of an IT superpower. When IT is used for common people, for downtrodden, for education, healthcare, water irrigation, agriculture, for entire economy and bottom 60% of society, then IT would reach the lower most strata of the economy. Only few top people writing code and making money is not what IT superpower is all about. Actually coding does not require too much of intelligence either. Few people go to America as programmers, become consumerist, buy lot of goods there. They write Java programs and think that they are far more intelligent than others. This is a wrong concept of progress. IT should be used for real needs of India. If that happens, we can say India is an IT superpower.**

**Q.5. Why have there not been purely software product companies in India or very few for that matter? I will really hold large companies responsible for this situation. Product design and essentially product marketing are very big challenges. You cannot be sitting in India in some corner of your house and design products for America. You ought to be sitting there and understand their business, how it works and all that. E.g. today entire banking industry has changed the way it works. It is difficult to visualize how business works in America without actually being there.

I can understand why we did not enter into products in early eighties and nineties. At that time we did not have enough understanding of the way the American business works. We had just entered those market places with onsite services and so-called body shopping. First there was need to establish offices in California, New York, London, Sydney and other places. For creating products you need to understand the way business works there, understand how purchasing is done, how inventory is managed, how manufacturing is done, how just-in-time concepts are implemented, how banking is done and all that. To understand that, you need a large team of Business Analysts. SAP has very large teams doing business analysis and understanding of business processes with different segments working for different processes say for example purchasing, inventory and so on. I had been to Waldorf in Germany several times and had great relations with SAP when I was in Syntel and L and T. I have seen that their teams are constantly looking at various business processes, how they can be changed, improved and so on. They are highly paid people with hundreds of them doing business analysis in various Business segments like Manufacturing, Retail, Education etc. So, you really need to spend lot of money for designing products and that design has to be done overseas. You need to have an office along with number of employees there. Thus, there is huge investment involved in all this. This is only the design part. In addition, to market the product, one has to attend several seminars and exhibitions. I have seen companies spending huge money on advertisements and promotions.**

The Indian companies did not have that kind of money then in eighties and nineties. Patni, Infosys, TCS all were growing at that time and it was simply not possible to think of entering into products in a big way for the international market.

However, after 2000 India has multi billion dollar software companies. We compete with some of the best companies in the world. I cannot understand what prevents them today from actually developing many products. We have large profitable companies, have lot of cash and foreign exchange. We can spend money and can set up foreign offices. It really pains me to see that we have not attempted at making products. In quite a few areas we could have made attempts but we have not. We have not grown out of our timid attitude. When we render services, we send people overseas on Friday, and billing starts on Monday. Initially, Indian companies got used to earning this easier money. In case of products, waiting period is quite large. In our formative years, we could not blame them as the Indian companies had to do a lot of work to establish centres overseas. But now in post 2000 era, if we look at market capitalization of some of our big IT companies, we find that these are multi billion dollar companies. I won’t expect them to throw all their money into products but except for banking and few small areas, there are no Indian software products which we can be proud of. Whatever may be the reasons - and I agree that they may have their own reasons - but it pains me to see that there is no single Indian software product like Microsoft, Oracle and SAP, which we can proudly say that the whole world is using. In this situation what is the use of calling ourselves IT super power?

**Q.6. Recently we have been reading news about big IT companies acquiring and looking to acquire product companies including the start-up ones. However, critiques say product development is not into DNA of Indian IT companies. Why are they feeling such a need now? Is it because their clients are expecting more? Will Indian IT companies be able to grow on value-chain by such acquisitions? Acquiring product companies is a good sign. This is one way of growing products business. Product is certainly the highest**
form of value chain and below that there are services like business analysis and technical architecture, which are higher in value chain than coding and testing, which is at the lowest level. So it is a good sign that these acquisitions are happening and I welcome that. Using the acquisition strategy they should actually grow in value chain. Of course there is always a suspicion in my mind also whether they would adapt to product business successfully or not but acquisition is certainly a good idea to start doing product business.

Q.7. How far CMM and CMMI certifications help software service companies? They say Indian culture does not adapt to process culture easily, as we believe in being individual heroes rather than succeeding as a group. In that light, does the certification actually enable the organization to enhance its collective maturity to handle software projects?

I am not too sure today about the status of these certifications. But earlier these were basically marketing tools. CMM and CMMI did not actually necessarily translate into the quality within the company as such. But customer feels safer when they are dealing with a certified company as such. But customer feels safer and CMMI did not actually necessarily guarantee good quality. Regarding our capabilities of the company to whom we adapt to new technologies quickly. We adapt to new technologies quickly, as we believe in being individual heroes rather than succeeding as a group. In that light, does the certification actually enable the organization to enhance its collective maturity to handle software projects?

Q.8. What is the future of IT industry in general and to be specific for India in the context of both world economic dynamics as well as in the context of changes in technology e.g. Cloud computing picking up fast which is impacting infrastructure investments, ubiquitous computing due to proliferation of small hand held devices etc.? Frankly speaking because of slowdown, IT industry would have suffered a lot but because of rupee devaluation it has gained. So this rupee rate has saved the industry. But slowdown is bound to hit the industry. Changes in the technology need not impact our business as such since we adapt to new technologies quickly.

Technology may change the nature of work. We adapted to changes like object oriented programming and all that. With cloud computing also things need not change. With cloud computing, your design and implementation of a system changes, but that still will require coding, testing, architecting etc. This outsourcing will continue except for the slow down. So changing technology is not much of a risk or vulnerability for IT industry.

Real threats in my opinion are dollar rupee rate, global slowdown, international competition and last but not the least availability of skilled manpower. If you interview 100 people today, only 8 to 10 are capable of taking up a good job. People who come out of colleges are not immediately employable. Ratio of employable people is very low - some say it is 5%, some say 15%, while some others say 20%. That means out of 100 first class students, only 20 people are employable.

All these threats are challenges for IT industry and can make industry vulnerable. You cannot take it for granted that situation will continue as it is forever. Increase in salaries is also a kind of threat. NASSCOM has predicted that by 2017-18, our salaries in India will be comparable to world salaries and this is bound to impact the IT industry. Shortfall of skilled manpower, competition from east and far-east are also likely to be bigger risks in future. Frankly if somebody asks me today about doing a career in IT, I would say that there is no problem for at least next 5 years as IT industry will continue to grow. But if you ask me about 10 years down the line, I am not so sure. I have my own doubts. In 10 years world would have changed a lot. Whether green pasture of IT industry will continue or not is difficult to predict.

Q.9. Outsourcing has received strategic importance for organizations especially in case of IT outsourcing due to several reasons like fierce competition, companies wanting to focus on core competency, special skill set requirement of IT, changing technology landscape, attrition in the field of IT etc. In fact we witness these days that some newly founded organizations build their IT backbone with help of strategic IT partners. Will the trend continue or there are always limitations to what can be outsourced in IT and what cannot be?

The trend will continue and IT would be outsourced. So far as what can be outsourced is concerned, we can generally say that whatever is definable or well defined or relatively well defined (because there is hardly any specification which is static and will not ever change), say a chunk of programs for which specs are known, can be outsourced. Whenever task is not well defined or changes all the time, it cannot be or it should not be outsourced. Otherwise it is very hard to monitor outsourcing of such tasks that are not well defined. If you outsource such work and keep on changing specs every now and then, the arrangement is likely to go haywire. This is valid for anything whether it is hardware, software, cloud or whatever.

Challenge in outsourcing is again not coding issues but it is business/domain knowledge and business analysis capabilities of the company to whom you have outsourced. Whether they understand your business or not is very important. Real failure is usually not in coding but understanding the business of your company. If that understanding is good then outsourcing helps and works.

Q.10. What advice would you give to IT executives looking for leveraging outsourcing strategically regarding selection of IT vendor, kind of service to outsource, long term maintenance of win-win partner relationship with the IT vendors etc.?

Long-term maintenance of outsourcing relationship is certainly a good idea. Whether to outsource to multiple vendors or not is a tactical issue. You should certainly not depend on only one vendor. I would definitely say - outsourcing few apps to one vendor and few others to some other vendor from selected vendors. Ideally there could be 2 to 3 preferred vendors. However, how you slice the work for outsourcing - whether vertically or horizontally, is up to you.

I will give an example - e.g. you can slice it technologywise or businesswise. I can give IBM mainframe work to one vendor, open source/open technology to another vendor, cloud-related work to somebody else and so on and so forth. This is an example of horizontal slicing based on technology used across various business areas. Another way of slicing is businesswise. I can give complete banking to one vendor, other business to another vendor whatever may be the technology used. If I am General Electric, I can give aircraft engines work to one vendor and consumer appliances work to another vendor. Now here it does not matter what technology is used in...
that business area - whether it is cloud, whether it is IBM mainframe etc. All technologies in that business area will be outsourced to a specific vendor. This is vertical slicing. How you slice the work for outsourcing is a tactical issue. It will depend on the capabilities and calibre of vendors and your management approach. Selecting 2 or 3 preferred vendors and slicing the work either way is the best approach.

Q.11. There have been many changes in the methodologies of software project management. Do you think that this discipline has now adequately matured?
You may call me little cynical but frankly speaking software project management continues to be a challenge whatever may be advances in methodology. It was a challenge 40 years ago and continues to be a challenge even today. There was waterfall model and then iterative and evolutionary and incremental methods came and now they talk about using agile methods. In waterfall model, you did analysis first then design and specifications were frozen before you started coding. In agile methodology, you allow customer to make changes while you do coding. This way you are actually going 40 years back when no specs were predefined. Then there were problems in managing projects where specs were not predefined, so it was decided to let the spec be frozen first. Later came iterative changes. Ultimately, what it means is you are exploring ways and means of adapting to various situations and changing customer requirements.

I do not really think that project success is related to any specific methodology as such. Methodology is all about adapting to customer needs, how often customer changes specs etc. So at the most, we can say that methodology facilitates project management little bit but for real success, you have to understand project management thoroughly - in terms of managing people, understanding each one’s capabilities, knowing how to delegate work, how to motivate people, how to monitor progress etc. All this is the essence and blood and bones of project management. That is where we fail many times. In my lecture (I am often invited to speak to a group of top level managers to teach them how to get to the CEO level since I have been a CEO or a Managing Director for a major part of my career). I mention 5 reasons of project failure -

(1) Goals or objectives of the project – decide what do you want to do, for whom (e.g. top management ...) and why (e.g. improve sales, efficiency, reduce risk etc.? If this is not clear, then there is a problem in the very basics.

(2) Scope - understand functional details e.g. Will payroll include HR also? People do not understand the scope of business requirements and therefore estimations go wrong which leads to failure.

(3) People - select the right people - analysts, architects, designers, programmers, project managers etc. and train them (normally you do not get people who are exactly suitable and so you need to train them), allocate / delegate work to them, and motivate them. People management is very important which if not properly done will lead to failure.

(4) Monitoring the work and continuously motivating team, and finally

(5) Delivery and closure of the project and learning from mistakes.

If any of these steps is not executed properly, a project can fail. Thus project success is not because of any specific methodology or some such thing like filling this form and that form etc. Many times people do not understand the scope of the project. They may use function points or xyz or any of the several methodologies available for estimation but if they do not understand why customer is doing the project, they can go wrong. Also if they do not choose the right people for the project, project is likely to fail. I have worked for 32 years and I have also made some mistakes. Many times instead of selecting right people, you are forced to use people from whosoever are available as there is usually a shortage of people and then in that situation, project management does become a big challenge. Beggars cannot be choosers. I understand that it’s fine to insist on the selection of the right people but sometimes there is no choice. Due to business compulsions and unavailability of training material, unavailability of good instructors, training the selected people also becomes difficult. Majority of software professionals want to do projects and go to America. They do not want to do training. Thus there are several reasons and issues why projects fail. However, success or failure of a project does not depend on any methodology.

Please note that cover themes of future issues of CSI Communications are planned as follows -

- November 2013 - ICT in Agriculture (Please note that same theme as that for October 2013 continues for November 2013)
- December 2013 - Medical Informatics
- January 2014 – Computer Vision
- February 2014 - Open Source Technologies
- March 2014 - Indic Computing

Articles and contributions may be submitted in the categories such as: Cover Story, Research Front, Technical Trends and Article.

Please send your contributions before 20th August for consideration in September 2013 issue.

For detailed instructions regarding submission of articles, please refer to CSI Communications March 2013 issue, where Call for Contributions is published on the backside of the front cover page.

[Issued on behalf of Editors of CSI Communications]
JavaScript and Cross Origin Security Restrictions

Abstract: This article is the fourth in the series of articles, focusing on security of the web platform. So far, we have explained the basic security model of web browsers, web interactions triggered by web elements and declarative security features in HTTP. In this article, we focus on some of the common operations done using JavaScript and the security restrictions imposed on them in case cross origin interactions are involved.

Introduction
JavaScript is a client side scripting language which enriches the web with several interactive features. Though in the initial days of the web, JavaScript was used only for validation, as the web evolved, it has reincarnated into a strong programming force. Today, almost every website uses JavaScript for tasks such as manipulating Document Object Model (DOM) of a web page, registering events, sending information to servers, consuming Application Programming Interfaces (API) of other websites, invoking APIs of modern web standards (HTML5) etc., in addition to validation. Several popular JavaScript libraries[1] such as DOM manipulation libraries (jQuery, YUI, Dojo, Prototype etc.), web application architecture related libraries (AngularJS, Backbone.js etc.), visualization libraries (D3.js, Processing.js etc.), templating systems (Mustache, Twitter Bootstrap etc.) have evolved, which perform the aforementioned tasks and make the life of web developers easier.

In the excitement of learning the APIs of new libraries/technologies which are based on JavaScript, most web developers do not focus on the security restrictions imposed on JavaScript by browser security model. Since most of the libraries encapsulate the internals and expose simple APIs, developers often get confused on what is possible and what is not using JavaScript. In this article, we explain why certain JavaScript operations are possible and why seemingly similar operations throw security violation error. We explain these with the help of some simple APIs, developers often get confused on what is possible and what is not using JavaScript. In this article, we explain these with the help of some demos explained in this article, we have hosted one web application on port 80, the default HTTP port and the other pointing to a remote file “remote.html”, which is a web page hosted on port 1337. Both the web pages have a div each (“divLocal” and “divRemote”) which contain some text. The script has two functions, each of which fire after the corresponding iframe has loaded. In both the functions, the script (which is executing in the origin “http://localhost:80”) attempts to read the DOM inside each iframe. Fig. 1 shows a screenshot of Chrome developer tools (invoked by pressing the “F12” key on Chrome browser) capturing the output of both these operations in the “console” tab. In the first case (“ifrLocal.onload”), since the iframe loads an HTML file belonging to the same origin as that of the parent page, the script executes successfully. In the second case (“ifrRemote.onload”), since the iframe loads an HTML file belonging to a different origin (http://localhost:1337 - different port number, hence different origin), SOP blocks the iframe access.

<table>
<thead>
<tr>
<th>Listing 1: HTML code showing Same origin and Cross origin DOM access.</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;body&gt;</code></td>
</tr>
<tr>
<td><code>&lt;iframe id=&quot;ifrLocal&quot; src=&quot;local.html&quot;&gt;&lt;/iframe&gt;</code></td>
</tr>
<tr>
<td><code>&lt;iframe id=&quot;ifrRemote&quot; src=&quot;http://localhost:1337/remote.html&quot;&gt;&lt;/iframe&gt;</code></td>
</tr>
<tr>
<td><code>&lt;script language=&quot;javascript&quot;&gt;</code></td>
</tr>
<tr>
<td>varifrLocal=document.getElementById(&quot;ifrLocal&quot;);</td>
</tr>
<tr>
<td>ifrLocal.onload=function(){</td>
</tr>
<tr>
<td>console.log(&quot;ifrLocal.onload&quot;);</td>
</tr>
<tr>
<td>var localDocument=ifrLocal.contentWindow.document;</td>
</tr>
<tr>
<td>var localText = localDocument.getElementById(&quot;divLocal&quot;).innerText;</td>
</tr>
<tr>
<td>console.log('Local text: ',localText);</td>
</tr>
<tr>
<td><code>};</code></td>
</tr>
<tr>
<td>varifrRemote=document.getElementById(&quot;ifrRemote&quot;);</td>
</tr>
<tr>
<td>ifrRemote.onload=function(){</td>
</tr>
<tr>
<td>console.log(&quot;ifrRemote.onload&quot;);</td>
</tr>
<tr>
<td>var remoteDocument=ifrRemote.contentWindow.document;</td>
</tr>
<tr>
<td>var remoteText = remoteDocument.getElementById(&quot;divRemote&quot;).innerText;</td>
</tr>
<tr>
<td>console.log('Remote text: ',remoteText);</td>
</tr>
<tr>
<td><code>};</code></td>
</tr>
<tr>
<td><code>&lt;/script&gt;</code></td>
</tr>
</tbody>
</table>

The page has two iframes, one pointing to a local file “local.html” and the other pointing to a remote file “remote.html”, which is a web page hosted on port 1337. Both the web pages have a div each (“divLocal” and “divRemote”) which contain some text. The script has two functions, each of which fire after the corresponding iframe has loaded. In both the functions, the script (which is executing in the origin “http://localhost:80”) attempts to read the DOM inside each iframe. Fig. 1 shows a screenshot of Chrome developer tools (invoked by pressing the “F12” key on Chrome browser) capturing the output of both these operations in the “console” tab.
Web developers come across this cross origin DOM access error while embedding third party content in their web applications via iframes and trying to access its DOM. A popular way of overcoming this problem is to embed third party content directly into web pages with the help of third party JavaScript libraries, which append new nodes to the parent DOM tree. Since the third party content is now a part of parent page’s DOM, it can be accessed and manipulated without any SOP violation. E.g., a third party map can be embedded into a page via an iframe, but due to SOP violation, JavaScript on the main page will not be able to modify the map (e.g., operations such as adding pushpins, text etc. on the map will not be possible). If the same map is added by embedding a JavaScript library provided by the mapping software, it will be a part of parent page’s DOM and hence JavaScript on the main page will be able to customize the map. The downside of embedding third party JavaScript is that trust is delegated to the third party server. If the third party server is compromised by an attacker, the embedding script can be made malicious, thereby adversely affecting the page integrating the content.

To mitigate these two problems (iframe’s cross origin access and JavaScript’s trust delegation), a new standard called “Post Message” was introduced in HTML5[5]. Using the Post Message API, two cross origin iframes can communicate with each other once they verify their origins. We will explain Storage Access

JavaScript does not have access to local file system and its only storage mechanism prior to HTML5 was cookies. Since cookies have several limitations with respect to size of storage, security and network overhead, HTML5 introduced several new storage mechanisms, of which local storage is one. JavaScript’s access to this storage is also governed by Same Origin Policy. This means, the local storage of any two distinct websites is isolated by origin and they cannot access each other’s storage data. Listing 3 shows JavaScript API to store and read data from local storage.

```javascript
<script language="javascript">
    window.localStorage.setItem('dept_number',"111");
    var dept_number = window.localStorage.getItem('dept_number');
    console.log('Department number: ',dept_number);
</script>
```

Listing 3: Setting and getting values from local storage

The first demo where we have explained cross origin DOM access can be modified with the code in Listing 3 to see SOP restrictions on storage. In both “local.html” and “remote.html” files which were loaded via iframes, data has to be set via local storage API as above. An attempt to read the stored data in “local.html” from the parent page will be successful (since both the parent page and “local.html” belong to the same origin-http://localhost:80), whereas an attempt to read the stored data in http://localhost:1337/remote.html from the parent page (http://localhost:80) will be blocked with the same error as shown in Fig. 1.

Network Access

AJAX (Asynchronous JavaScript And XML) is a technique in which JavaScript can send data to and receive from a server, directly from within the browser, asynchronously. AJAX is the reason behind silent partial page updates which happen regularly on the web (e.g., automatic updating of stock tickers, score boards etc.). AJAX calls are also regulated by Same Origin Policy, which means, a webpage can make an AJAX call only to its own origin. i.e., script in a webpage loaded from http://gmail.com can make an AJAX call only to http://gmail.com. If such a restriction was not in place, any ad-hoc website will be able to trigger an AJAX call and delete mails from Gmail’s server.

Let us look at a demo on the restrictions of SOP on AJAX calls. We have used jQuery[2] in our demo as it is the JavaScript library which most web developers are familiar and comfortable with.

Listing 4 shows the jQuery code[3] in “index.html”, for making an AJAX call to the page “local.html” (both belonging to the origin “http://localhost:80”). This AJAX call succeeds as shown in Fig. 2.

```javascript
$.ajax{
    url: 'local.html',
    success: function (response) {
        console.log('success');
    },
    error: function (jqXHR, status, errorThrown) {
        console.log('error');
    }
};
```

Listing 4: jQuery code for making an AJAX call to a web page.

Now if the “url” parameter in $.ajax is changed to http://localhost:1337/remote.html (i.e., cross origin because the ports are different) and the page is reloaded, the call fails due to SOP violation. Fig. 3 shows a combined screenshot of “network” and “console” tabs of Chrome developer tools displaying this error. The network tab shows the status of the call as “cancelled”, while the console tab shows an error message. The call failed due to SOP violation but the error message in Chrome gives additional information saying “Origin http://localhost is not allowed by Access-Control-Allow-Origin”. The string “Access-Control-Allow-Origin” is a HTTP response header introduced in HTML5 under CORS (Cross Origin Resource Sharing) specification. In short, HTML5 CORS allows Cross Origin AJAX,
provided the destination server approves it. We shall discuss more about CORS in our upcoming articles.

**How are APIs Consumed in Today’s web?**

Almost all modern websites expose their functionality via APIs, which can be consumed by JavaScript. An inquisitive reader will be confronted with the question—“If cross origin AJAX is blocked, then how are APIs consumed in today’s web?” The short answer is, developers use a technique called JSONP (JSON with padding) to bypass SOP restrictions. Using this technique, developers build APIs such that they return arbitrary JavaScript code (served with “application/javascript” or “application/json” mime type) which is injected into web pages and consumed. This is similar to embedding external JavaScript files via `<script>` tag. Most JavaScript libraries encapsulate this functionality and project as if they are making cross origin AJAX call to fetch data via APIs, but the fact is, they perform script injection.

E.g., If the code in listing 5 is run from any web page not belonging to Facebook, it will fail as shown in Fig. 4.

```
$.ajax('https://www.facebook.com/zuck', function(data) {
  console.log(data);
});
```

**Listing 5: Cross Origin AJAX call to Facebook**

However, if the URL is changed to `http://graph.facebook.com/zuck`, it will succeed as shown in Fig. 5. This is because, the content in this URL is served as “application/json” (you may check this with the help of browser’s developer tools.)

**Conclusion**

In this article, we have seen the security restrictions JavaScript has while performing cross origin operations (DOM access, Storage access and Network access). We have explained with code snippets how developers use these operations frequently and have also explained with the help of screenshots the kind of security errors which arise due to Same Origin Policy violation. Towards the end, we have thrown light on how libraries encapsulate information related to cross origin network access (JSONP) with a view to make developer’s life easy, resulting in misconception about cross origin AJAX. A clear understanding of these concepts plays an important role in understanding various web attacks and upcoming browser security policies, which we explain in our upcoming articles.

**References**

Krishna Chaitanya Telikicherla is a Research Associate with Security and Privacy Research Lab, Infosys Labs. His research focus is primarily on web security, specifically analyzing browser security policies, web attacks, defenses and formal verification of web specifications. He is a regular blogger and speaker at several developer and security meets in India. For his contributions to technical communities, Microsoft has presented him the prestigious “Most Valuable Professional (MVP)” award for 4 consecutive years (2010-2013). He can be contacted at KrishnaChaitanya_T@infosys.com

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Brain Teaser

Crossword »

Test your Knowledge on ICT in Agriculture
Solution to the crossword with name of first all correct solution provider(s) will appear in the next issue. Send your answers to CSI Communications at email address csic@csi-india.org with subject: Crossword Solution - CSIC October 2013

CLUES

ACROSS
2. Portal on agricultural in India (11)
6. Cutting of grain or pulse for harvest (7)
9. Application of fertilizers and water-soluble products through irrigation (11)
10. A vehicle used in mechanizing tasks in agriculture (7)
12. Indian Initiative for daily news and analysis on agricultural commodities (9)
13. Online Complaint Management System in Mumbai (4)
17. An initiative taken up by Central Agricultural University (5)
19. An exclusive agricultural portal for sharing knowledge (9)
23. An ICT in agriculture initiative for farmers initiated by NIC (4)
24. An initiative taken up by Gov of Kerala for families, women in particular (13)
27. An ICT in agriculture initiative for rural connectivity and allied services (8)
29. An agriculture information services system for farmers in Kerala (6,6)
30. An agricultural hand tool for mowing grass (6)

DOWN
1. Agricultural informatics and communications network initiative by Ministry of Agriculture, GoI (8)
3. Initiative for rural access to services through Internet (4)
4. Radio frequency technology used for reading data (4)
5. An initiative of ITC Limited to link directly with rural farmers (8)
7. A knowledge source used for interaction among the farmers (9)
8. A satellite navigation system based on spatial coordinates (3)
11. A land record computerization project (6)
14. Am initiative taken up by IIIT, Hyderabad for farmers (5)
15. Project for automated milk collection centers of Amul dairy cooperatives (4)
16. National agriculture technology project taken by Dept of Agriculture and Co-operation of India (9)
18. An initiative by ITC for shrimp farmers in Andhra Pradesh (11)
19. Rural Cybercafes on Intranet project in Madhya Pradesh (8)
20. Tamil Nadu Women in Agriculture Initiative (5)
22. Most commonly used nutrient in fertilizer program (8)
25. Process of gathering mature crops from fields (7)
26. An ICT in agriculture initiative taken up by IIIT, Bombay targeted for farmers in Pune (5)
28. Microsoft-NASSCOM Foundation’s initiative as rual knowledge center (3)

Did you know about newsletter on ICT in agriculture?
First Newsletter from the World Bank on ICT in Agriculture came out in May, 2012. This an initiative from Agriculture Task Force, whose members are part of the Agriculture and Rural Development Department (ARD), the ICT Sector Unit (TWICT), and regional offices at the World Bank. For more details, you may visit http://www.ictinagriculture.org/

We are overwhelmed by the responses and solutions received from our enthusiastic readers

Congratulations to
Madhu S Nair (Dept. of Computer Sc., University of Kerala, Karivatvom, Thiruvananthapuram, Kerala)
for ALL correct answers to September 2013 month’s crossword
The following are the ICT news and headlines of interest in September 2013. They have been compiled from various news & Internet sources including the dailies – The Hindu, Business Line, and Economic Times.

Voices & Views
- South Korea spends 3.74% of its GDP on research (the most), Japan spends 3.67%, the US spends 2.7%, and fast growing China spends 1.97% where as India invests only 0.9% in research – VIT Chancellor.
- Nasscom has projected a growth rate of 12-14% for 2013-14, 30% of the revenues would from the new areas such as social, mobility and analytics.
- India’s best days in supercomputing are around the corner – VP, Intel Architecture Group.
- There is shortage of skilled talent in cyber security – Arthur W. Coviello, Executive VP, EMC.
- India today consumes close to $7 billion of semiconductor products every year. By 2020, when the total ESDM market is expected to reach $400 billion, this consumption is expected to touch $55 billion.
- As semiconductors constitute about 10-15% of any electronic product on an average (around 25-35% for mobile phones and set-top-box), setting up local fabs will have an impact on local value addition.
- First ‘Made-in-India’ chip in 2-3 years – Sibal.
- The audio visual (AV) market in India is expected to grow at 25% to touch $51 billion by 2015 while global AV market is projected to grow by 14% to generate $115 billion.
- IT sector revenue to cross $225 b by 2020. The global ICT spending will reach the $5-trillion mark by 2020 driven by the combination of social media, mobility, analytics and cloud – CII report.
- SME market for telecom service in India is estimated at Rs 10,500 crore and likely to grow at 8.1% to Rs 16,800 crore by 2017-18.

Govt, Policy, Telecom, Compliance
- Telecom PSUs ITI & CDOT spar over broadband tech deal. DoT rejects ITI’s plea to break broadband tech deal with C-DOT.
- Dumping duty on DVDs from China, Hong Kong and Chinese Taipei extended.
- For a fee, Maharashtra plans to allow Aadhaar enrolment at your doorstep.
- Telecom Minister Sibal looks to revive Aakash project, targets Govt schools. The scheme floated to cost Rs 5,000 crore and will be implemented by BSNL in four phases spread over three years. It will benefit some 90 lakh students who will also get for two years free 500 MB data usage, 75 SMS and 75 minutes of talk-time every month.
- PM to oppose US Immigration Bill penalising Indian IT firms. He will take up the issue during his meeting with US President Barack Obama in Oct.
- India can follow Bangladesh model on spectrum pricing – Manoj Kohli, CEO, Intl. Operations, Airtel.
- Operators to save Rs 1-lakh cr from TRAI’s new revised spectrum proposals.
- M&A guidelines for the telecom sector is likely to be ready by end of this month – Sibal.
- BSNL, MTNL to get Rs 11,000-cr refund, the amount paid by them to acquire broadband spectrum in 2010.
- Telcos’ volume down as instant messaging platforms woo people with “free voice call” apps.
- Cabinet okays proposals for setting up 2 semiconductor fabrication plants at an outlay of around Rs 26,300 crore & 25,250 crore respectively.
- With tax benefits gone, more export units will set up plants in India.
- Telcos’ volume down as instant messaging platforms woo people with “free voice call” apps.
- With tax benefits gone, more export units will set up plants in India.
- BSNL, MTNL, join hands to offer free roaming service.
- Procedural delays and lack of coordination among various stakeholders – BSNL, Railtel and Powergrid, have forced the Govt. to push back the completion date for the Rs 20,000 crore national optical fibre network project by two years to Sep 2015.
- Electronic firms approach Govt. for more time to get BIS tag.
- Full mobile number portability will not have any significant impact on the churn – DG, COAI

IT Manpower, Staffing & Top Moves
- Cogniti Technologies Ltd which had recently opened a Global Test Engineering Centre in Hyderabad and employing presently 800, plans to hire 400 in the next one year.
- Zensar Technologies launched an initiative called Jugnu (or fly) aimed at knowing the secret aspirations of employees and allowing them to pursue those aspirations.
- After staying with HCL Technologies for more than 28 years, Vineet Nayar is investing nearly Rs 90 crore of his personal money for social transformation initiatives through Sampark Foundation, an NGO and has signed an MoU with the Punjab Govt. to drive educational intervention.
- TCS & UK Govt. to create the Chevening-TCS Scholarship on cyber policy, In the first year, six Indian nationals will be selected to undergo a 12-week training in the UK.

Company News: Tie-ups, Joint Ventures, New Initiatives
- Microsoft acquires Finnish handset giant Nokia for $7.2 billion.
- Zensar Technologies has launched an Insourcing Services division to provide comprehensive services to global conglomerates to set up captive centres in India.
- Tech giants light up gadgets at the IFA 2013, one of the most-attended consumer technology trade fairs.
- Panasonic introduces the world’s first ever Ultra-HD television. Acer unveils new smartphone with the power to shoot video in a 4K resolution.
- Viom contracted to provide Wi-Fi, Net-based services at Chennai airport.
- Sify to invest in start-ups. Rs 120 crore will remain available to Sify for this.
- TCS has bagged a five-year e-governance deal to electronically link up all police stations and provide real-time crime and criminal information in Goa.
- Intel launches Xeon ES-2600 v2 line of flagship server chips for computers running in data centres. The new chips are 45% more power efficient and deliver 50% more performance.
- CA Tech is looking at investing in start-ups in India through Nasscom’s start-up initiative.
- Amazon, in India to add new product categories for festival season.
- EMC unveils the ‘Project NILE’ Elastic Cloud Storage platform focused on delivering private cloud control, security and flexibility, economics and ease-of-use.
- Oracle launches Database12c (or DB12c) in India and aims to bring cloud closer to SMEs.
- India-born Watsa, Chairman and CEO of Fairfax Financial Holdings offers to buy smartphone-maker BlackBerry at $4.7 b.
- Oracle opens cloud marketplace for business with over 100 apps.
The book titled “Learning Oracle SQL and PL/SQL – A Simplified Guide”, authored by Rajeeb C. Chatterjee and published by PHI Learning Pvt Ltd (361 pages price Rs 350), presents a systematic knowledge of the Oracle database which is an extremely powerful and flexible relational database management system. Of course, to explore its full power and flexibility, a user has to study it very carefully and confidently.

This book will help a learner to become a good database application developer. It can be used even by a beginner who has very little theoretical knowledge about database and its management system. Only a computer with Oracle package installed will be necessary for him/her to start.

The step-by-step approach with sufficient explanations, spreading over 29 chapters, can be easily understood and appreciated without further guidance. Even a professional developer can make use of this book as a ready reference. This book comprehensively explains all the concepts and approaches used in Oracle. Its simplified presentation can enable students to grasp the subject quite easily and quickly. The emphasis throughout the text is on using Oracle’s capabilities in an effective and efficient manner.

Students should go through two cases given in the first chapter to understand the examples and exercises discussed throughout the text based on those cases. They will appreciate how real-life application requirements can be taken care of. Additional examples have been included wherever they are deemed necessary. For most of the exercises, solutions have been provided for the benefits of students. The systematic approach to the subject with suitable examples makes the book a complete and an effective self-study guide.

The book is intended for use by the students of Computer Science and Engineering, Information Technology, MCA or similar professional courses. Even GATE candidates can make use this book to answer questions on SQL correctly. Moreover any job aspirant for IT industries can take help of this book to quickly revise his/her knowledge on Oracle, SQL and PL/SQL.

The book will be useful for young faculty members who are conducting practical classes on DBMS/ORACLE or guiding projects and orienting students for campus interviews. Professionals can choose the book as a study material while conducting any training programs on Oracle database.

The readers of the book will find it quite interesting, practical oriented, thought stimulating and completely self-study type.

Author of the book
Rajeeb C. Chatterjee, Former Senior Consultant, Oracle Applications SBU, PricewaterhouseCoopers Limited, Kolkata, is a visiting faculty in the Department of Information Technology, Jadavpur University. He has more than 20 years of teaching experience and a vast practical experience in developing industry-oriented application software using Oracle and other databases. He is an active member of the database community for more than two decades. His areas of interest include database management systems and software engineering.

Prof. (Dr.) Ananda Mohan Ghosh was the first professor and head, Department of Computer Science and Technology, Bengal Engineering and Science University (BESU), Shibpur, West Bengal. He has had about thirty five years teaching and research experience in the fields of DBMS, Computer Networking and Artificial Intelligence. He was awarded ‘Distinguished Computer Engineer of the year – 2001’ by the Institution of Engineers (India) and received a ‘Distinguished Teacher’ award from BESU in 2010 convocation.

Chandan Giri did his bachelor's and master's in Computer Science from Jadavpur University, Kolkata. He is presently Managing Consultant of IBM India (Global Delivery), Kolkata. He has had more than twenty years’ experience in the field of software development life-cycle using DBMSs like Oracle.
CSI Awards for Excellence in IT have achieved iconic stature among various awards in the area of IT applications in industry. We have maintained absolute transparency and highest standards of evaluation process while deciding these awards and will continue it for years to come. CSI being a non-profit body comprising of computer professionals has been able to help these awards set exemplary milestones in terms of number of entries and quality of nominated projects. Industry has appreciated the selection process and the high standards of evaluation criterion adopted by Jury. Needless to say, participation has been with unparalleled zeal across all categories leading to best of the projects winning awards during previous years. Cash award to the leader of winning team is an icing to the stature of these awards.

President’s Message

CSI Awards for Excellence in IT have been instituted for recognizing and rewarding outstanding professionals from the corporate sector for their contributions in demystifying the IT Trends for growth and development of the Nation. In this mission of inspiring and creating new avenues of development, CSI plays a vital role. By Bench- Marking and recognizing the Corporate Excellence “CSI Awards for Excellence in IT” has moved forward in a big way. I congratulate the team for putting up an untiring effort to hold this felicitation for last 3 years.

SV Raghavan, President CSI

Chairman Awards Committee’s Message

CSI is presently at the fourth year of the “CSI Awards of Excellence in IT”. These awards, meant to identify and recognize highly successful IT Projects in different domains such as Banking, Telecom, and Manufacturing, have become one of the most visible in the country. The process of identifying winners has been improving through the last three years, and is expected to mature and stabilize by this year. By participating in these awards, not only does each project have a chance of getting noted for its innovation, scale and impact, but it is also a good opportunity to be exposed to other excellent projects from around the country.

On behalf of the Awards Committee of the Computer Society of India, I invite projects from all the relevant sectors to participate in the awards process and showcase your IT Project Achievements to the nation.

Satish Babu, Chairman CSI

Convenor’s Desk

On this fourth year of our association and binding, I congratulate all our stakeholders and participants for the wonderful show we have been able to put up. Since our beginning, we have been trying to improve and stabilize these coveted awards every year. Our last years’ experience gives us an excellent feedback of attaining high level of performance and selection of categories for the excellence awards.

At this point we feel that the focus this year should remain on use of technology as we did last year and for that our team has identified seven different categories. As it is brought out, any project with application of latest technology will qualify to be nominated in one category or other. This is a paradigm shift from being Industry oriented to Technology specific. In industrial applications we achieve excellence in performance only through use of innovative and most up to date technology. Awards this year would certainly bring out the most outstanding usage of technology to achieve excellence in performance and delivery systems.

Anil Srivastava, Chairperson & Convener, csi.itawards@csi-india.org

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Calendar
- Launch of website 30th September 2013
  www.csinationalawards.org/excellenceaward2013
- Curtain Raiser Show: 30th September 2013, During AGM, Mumbai Chapter and 4th October 2013, During TIECON Annual Event, New Delhi
- Start of Online Submissions: 7th October 2013
- Last Date of Submission: 25th November 2013
- Tier 1 Process: 26th November 2013 to 30th November 2013 (Online)
- Tier 2 Process 1st Week of December 2013 (Mumbai)
- Tier 3 Process 2nd week of December 2013 (New Delhi/Mumbai)
- Grand Finale 13th - 15th December 2013 (Vishakhapatnam)
**Year 2013, the Sectors of Excellence at a Glance:**

|-------|-----------------------------------------|-------------------|-------------------|----------------|----------------|
| 1     | Business Collaboration Solutions : Banking & Finance | ICT, Mobile, Cloud, Geospatial & Innovative Technology | Organizations/Companies operating in the Private & Public Sectors : SME’s, OEM’s, NGO’s, Product & Device Manufacturers, Mobile & Telecommunication Companies, Aviation & Automotive companies, Banking & Financial Institution, Insurance Companies, Educational Institute, IT Companies including Hardware Manufacturers & Software Developers, IT Consulting Companies, IT Service & Solution Providers, BPO /KPO/ Call Centres or any other company dealing in these sector of excellence. | • Criticality of IT Usage  
• Process Re-engineering  
• Improvement of Customer Service  
• Innovation  
• Return on Investment  
• Quality of Management Impact : Organizations/ Society / Green IT / CSR | The Most Outstanding Project/Produc t/Service/ Solution completed within last 12 months, using ICT, Mobile, Cloud, Geospatial & Innovative Technology |
| 2     | Advance Analytics : Products, Designs & Solutions | | | | |
| 3     | Design & Engineering Solutions : Product Manufacturing | | | | |
| 4     | Education & e Learning : Products & Solutions | | | | |
| 5     | Health care : Infrastructure & Solutions | | | | |
| 6     | Transport - Air, Rail & Road : Products, Designs & Solutions | | | | |
| 7     | IT Infrastructure & Equipment Solutions | | | | |

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**CSI Awards for Excellence in IT**


**Selection Committees**

The Jury nominated for conducting the selection process would comprise of: Senior CSI members, Top Industrialists, Renowned Academicians and well known practitioner’s of Information & Communication Technology. Absolute transparency would be maintained in the selection process.

**Three Tier Selection Process**

- **Tier 1**: Online Scrutiny, assessment and technical audit of submissions by our Knowledge Partners
- **Tier 2**: Presentation by all short listed & selection of Top 5
- **Tier 3**: Presentation by top finalists during annual convention for selection of Winners

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For any queries please contact:

Ranga Rajagopal  
Hon. Treasurer (2013-15) AT  
email: rangit.rajagopal1@rediffmail.com  
or +91 9442631004

Awantika Varma  
Co-Convenor, Awards for Excellence in IT  
email: awantikavarma@csi-india.org  
or Mob: +91 9893372126

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**COMPUTER SOCIETY OF INDIA**

Samrudhi Venture Park, Unit no 3, 4th Floor, Marol Industrial Area, Andheri (E), Mumbai – 400093.  
Email: cs.iitawards@csi-india.org; awantikavarma@csi-india.org, http://cstinationalawards.org/excellenceaward2013

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**Our Media Partner**

**Our sponsor partner**
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 CSI Reports

From CSI SIGs / Divisions / Regions and Other News »

Please check detailed reports and news at:
http://www.csi-india.org/web/guest/csireports

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<th>SPEAKER(S)</th>
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Release of Proceedings of ACC 2013 (in CD)

COMPUTER SOCIETY OF INDIA-EDUCATION DIRECTORATE, CHENNAI AND JEPPIAAR INSTITUTE OF TECHNOLOGY WITH MEDIA LAB ASIA

Dr. Kannan, Dr. Prof Jayachandran, Mr. Baljit Singh Bedi, Mr. Gaurav Takkar, Mr. Rajan T. Joseph, Mr. K V Johny, Mr. S Ramasamy, Mr Gnanasekaran, Mr. Natarajan | 22 August 2013: Workshop for Special Educators “Punarjjani”
Punarjjani is a web based integrated evaluation tool for the mentally retarded children. A child with mental retardation undergoes a comprehensive evaluation to determine the nature of services required. Evaluation is done for three purposes: diagnostic, instructional, and progress monitoring. Following this evaluation, collected data is translated into statements of special education needs. The package will be capable to assess each MR children based on the inputs given by the teacher. Based on the assessment results the system can suggest a suitable long term goal for each child. This long term goal will be further divided into short term goals. For each short term goal the system will try to suggest a suitable lesson plan. A total of 140 Special Educators attended the workshop which is a resounding success. The workshop was inaugurated by Mr. Baljit Singh Bedi, spoke about the Government initiatives in Health Care and Rehabilitation. Mr. Gaurav Takkar spoke about the impact of Media Lab Projects. Mr. Rajan T Joseph, narrated about the CSI Initiatives. The workshop sessions were handled by Mr. K V Johny, Concluding remarks were given by Mr. Bhatia.

Dr. P Sakthivel, Prof. P Thrimurthy, Mr. H R Mohan, Prof. P Kumar, and Mr. S Ramasamy with the two winning teams

COMPUTER SOCIETY OF INDIA-EDUCATION DIRECTORATE, CHENNAI WITH RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI

Prof. P Thrimurthy, Mr. H R Mohan, Dr. P Sakhthivel and Mr. Bhuvaneswaran | 1 September 2013: Young Talent Search in Computer Programming – 2013

12 teams from different parts of the country, selected through their respective regional competitions, qualified for participation and all the 12 teams participated. The Delhi Public School and National Public School are top two teams who won the first and second positions and qualified to represent India at the SEARCC International Schools’ Software Competition 2013 which will be held in Colombo, Sri Lanka between 24th and 27th October, 2013. Trophies and Certificates were presented to the winning teams.

Dr. P Sakhthivel, Prof. P Thrimurthy, Mr. H R Mohan, Prof. P Kumar, and Mr. S Ramasamy with the two winning teams
CSI News

From CSI Chapters »

Please check detailed news at:
http://www.csi-india.org/web/guest/csic-chapters-sbs-news

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<tr>
<th>SPEAKER(S)</th>
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<tr>
<td><strong>AHMEDABAD (REGION III)</strong></td>
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</table>
| Prof. Diwanji Hiteishi, Prof. Dhaval Parikh, Prof. Sujoy Pal and Prof. Jayesh Solanki | 6 March 2013: Special Lecture on “Benefits of Joining CSI”
Prof. Hiteishi inspired students to actively participate in various events. Prof. Parikh encouraged them to join CSI and suggested to enhance their career by involving in this prestigious and professional body. Prof. Pal enumerated benefits of CSI membership. Prof. Solanki motivated students for active participations in various activities and explained the procedure of acquiring CSI membership.

| Prof. Sujoy Pal, Prof. Jayesh Solanki and Mr. Sunny Vaghela | 14 August 2013: Seminar on “Ethical Hacking and Information Security”
Prof. Pal enumerated benefits of CSI membership to participants. Prof. Solanki briefed participants about various activities conducted by CSI Ahmedabad Chapter. Mr. Vaghela demonstrated his expertise on ethical hacking and information security to the participants.

| **RAJKOT (REGION III)** | |
| Prof. R P Soni, Dr. Harshal Arolkar, Dr. C K Kumbharana, Prof. V R Rathod, Dr. Y P Kosta, Dr. R Sridaran, Prof. Sunil Bajeja and Prof. Hardik Gohel | 20 July 2013: Inauguration of CSI Rajkot Chapter
During inaugural speech Prof. Soni spoke about how CSI helps in future development of computer savvy members. He highlighted how the chapter could benefit students community at large. Dr. Arolkar insisted on involvement of members. Dr. Kosta mentioned technical need and motivated students to join CSI for their own growth. Dr. Sridaran appreciated faculty members who took initiative in forming the chapter. A web site was also launched for Rajkot chapter.

| Dr. Bireswar Das, IIT Gandhinagar and Prof. Bhavesh Javani | 14 September 2013: One-day Seminar on “Combinatorial Games and Puzzles: A complexity Theoretic Perspective”
Dr. Das talked about mathematical approaches which are considered as very important while preparing or constructing games. He talked about issues faced while preparing a game code.

| **BANGALORE (REGION V)** | |
| Bhanumathi K S and Mr. B G Suresh | 9 August 2013: Workshop on “Cloud Computing”
Workshop covered Cloud Computing aspects such as - What/Why of Cloud Computing, Cloud Computing Stacks - IaaS, PaaS, and SaaS, Cloud Delivery in terms of Public / Private / Hybrid Clouds. Reference IaaS architecture from Amazon was described. Participants were provided with full blown server and were able to create full LAMP (Linux, Apache, MySql, PHP) stack on it and also create a small web page to update backend database.

| Faculty members and participating students | Faculty members and participating students |
| Ms. Sunny Vaghela, Prof. Jayesh Solanki, Prof. Dipti Chudgar & Prof. Sujoy Pal. Mr. Vaghela conducting Seminar | Ms. Sunny Vaghela conducting Seminar |
| Guests and dignitaries on stage for Inauguration | Faculty member and participants during the seminar |
| Participants during the Workshop | Participants during the Workshop |
**COIMBATORE (REGION VII)**

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<tr>
<th>SPEAKER(S)</th>
<th>TOPIC AND GIST</th>
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<tr>
<td>Chief Guest Dr. A Selvakumar, Dr. Elijah Blessing and Dr. E J James</td>
<td>12 August 2013: Inauguration Ceremony of CSI Karunya Chapter called “EVOTECH 13” Dr. Blessing urged students to take active part in CSI events and keep themselves updated. Dr. James emphasized need of innovative thinking and improvised means of technology. Dr. Selvakumar informed about various activities to be held in the year. Prizes for various events were awarded to students. Technical quiz was conducted where participants had to answer 10 multiple choice questions. 15 students were selected and put into 5 teams for the final round.</td>
</tr>
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| Prof. K Subramanian | 22 August 2013: Programme on “Requirement Engineering for Cyber Forensics” Speaker spoke about various security techniques like authorization, audit trails, passwords, backups etc. He pointed out how various threats and attacks lead to loss of credibility, embarrassment, financial loss, losing to competitors and loss of customers for organizations and individuals. He touched upon issues and challenges in cyber forensics, cyber terrorism and various cyber auditing practices followed. |

**THANJAVUR (REGION VII)**

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<th>SPEAKER(S)</th>
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<tr>
<td>Dr. N Ramachandran and Mr. P Saravanan</td>
<td>13-14 September 2013: Two-says Workshop on “Android and Its Apps” Mr. Saravanan spoke about Android applications, evolution, version and advancement. Workshop continued with practical approach by developing simple application in level 1 process. More than 300 participants gained hands on experience in developing small Android application.</td>
</tr>
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**From Student Branches »**


**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCE (ANITS), VISHAKHAPATNAM (REGION-V)**

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<td>Prof. B Majhi, Dept. of CSE, NIT, Rourkela</td>
<td>13 June 2013: Guest Lecture on “Understanding Research” Prof. Majhi said that curiosity, persistence and open mind are key ingredients which make one involve in true research. Tips to identify topic for research and the life cycle of research process were vividly discussed by him. He also mentioned the does and don’ts of writing good research article and encouraged students to avoid plagiarism.</td>
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[ CSI Communications | October 2013 | 50 ](http://www.csi-india.org) [www.csi-india.org](http://www.csi-india.org)
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| MALLA REDDY ENGINEERING COLLEGE, HYDERABAD, ANDHRA PRADESH (REGION-V) | 19-20 July 2013: National Conference on "Information Systems and Knowledge Engineering - (MRNC ISKE-2013)"
Mr. Rama Murthy delivered talk on the importance of research in the field of Computer Science & Engineering. Research papers from various areas of Computer Science & Engineering came from Tamilnadu, Karnataka and Andhra Pradesh.

| MIT ACADEMY OF ENGINEERING, ALANDI (D) PUNE, MAHARASHTRA (REGION-VI) | 12-13 August 2013: Two-days Workshop on “Mobpreneur (Business planning with software application development)”
Objective was to teach students basics of entrepreneurship and web and mobile technology used worldwide. There was mega preliminary competition round. Mr. Animesh conducted hands on and idea generation sessions. Idea generation contest was held among participants. UNIDO, Emergency Services and Source Code were selected ideas for next round.

| ADI SHANKARA INSTITUTE OF ENGINEERING & TECHNOLOGY, KALADY, KERALA (REGION-VII) | 02 August 2013: Two-days Workshop and Competition on “Android”
Participants were told about IDE (ECLIPSE with Java). Familiarization of platform installation and basic programs was given. Students were also told about XML Designing including how to define buttons, layouts, text boxes, fonts, how to run applications both on virtual device and on real device. Next they were asked to form team and decide on idea of an app. Intents, databases, accessing the Internet and uploading your app onto the GOOGLE PLAYSTORE were some of the topics covered.

| ADHIYAMAAN COLLEGE OF ENGINEERING, HOSUR, TAMIL NADU (REGION-VII) | 21-22 August 2013: Two-days Intra College Technical Symposium
Mrs. Darsanic delivered inspiring speech. Dr. Ranganath presided over the function. About 300 participants participated in various technical and non-technical events like paper presentation, technical Quiz, Debugging, code building etc.

| DR. RANGARAJAN DR. SAKUNTHALA ENGINEERING COLLEGE, AVADI, TAMIL NADU (REGION-VII) | 10 September 2013: National Level Technical Conference “RECHZIG’13”
It was spectacular event which provided a platform for students to showcase their talents. It was conducted by three departments viz. CSE, MCA, IT. Around 350 papers were registered on various domains and after many reviews 85 papers were selected. These papers were selected based on Innovation, Technology and depth of the concepts. 10 papers were rewarded as the Best papers.

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<th>SPEAKER(S)</th>
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<tr>
<td>EINSTEIN COLLEGE OF ENGINEERING, TIRUNELVELI (REGION-VII)</td>
<td>Mr. Sundar Alagarswamy, Mr. Prashant R Nair, Mr. Y Kathiresan, Prof. A Ezhilvanan, Dr. K Ramar, Prof. R Velayutham and Prof. M Suresh Thangakrishnan</td>
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<td><strong>06-07 September 2013:</strong> 8th Tamilnadu State CSI Student Convention</td>
<td>Mr. Alagarswamy delivered key note address on “Cloud Computing and Open Source Software”. Web designing contest was conducted in which 52 students from various colleges participated. 45 teams from various colleges presented paper in recent technologies, 28 students participated in poster presentation, 116 students participated in code debugging and 103 students participated in CSE freak.</td>
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| ER. PERUMAL MANIMEKALI COLLEGE OF ENGINEERING, HOSUR, TAMIL NADU (REGION-VII) | Mr. Siddharth Goyal, Founder and CEO, Dulcet Solutions |
| **10-11 August 2013:** Workshop on “Web Technology” | Mr. Goyal gave training to students in web based tools. Totally 80 students participated. After competition talented students were selected for next stage where they were mentored by experts from Microsoft, Google, Sap, Freemont Partners, KAE Capital, Mumbai Angles and leading MNCs for taking part in Techunt. Certificates were issued to all participants and Certificate of Achievement was given to top 3 teams. |

| KNOWLEDGE INSTITUTE OF TECHNOLOGY (KIOT), SALEM (REGION-VII) | Mr. Karthik Ragubathy, CEO, LearnFlow |
| **01-03 August 2013:** Workshop on “Web Application Development” | Mr. Ragubathy demonstrated basics of web designing and provided necessary foundation to designing web pages using HTML & CSS. Workshop focused on Server Side Scripting Language (PHP with MySQL) and Client Side Scripting Language (JavaScript). At the end participants were grouped in different teams who developed new website with different innovative ideas. |

| MEPCO SCHLENK ENGINEERING COLLEGE, SIVAKASI (REGION-VII) | Mepco SB team |
| **06 August 2013:** Workshop on “Claudy Quiz” | Technical Quiz event was conducted for 2013 freshers. Total of 9 team members participated. Participation was based on preliminary event which was conducted for nearly 60 students. Finally two teams were selected and were awarded Rs. 1000 and Rs. 500 as first and second prizes. Event had four rounds each testing technical knowledge as well as soft skills. |

<p>| RAJALAKSHMI INSTITUTE OF TECHNOLOGY (RIT), CHENNAI, TAMIL NADU (REGION-VII) | Dr. Mrs. Thangam Meganathan, Mr. RD Chandra Mohan, Dr. EN Ganesh and Dr. R Lalitha |
| <strong>5 April 2013:</strong> National Science Day Celebration | Mr. Chandra Mohan spoke on Cloud Computing and its practical implementations. Dr. Ganesh felicitated the gathering. Certificates and Trophies were given to Prize winners in Debugging and Paper presentation contest conducted for students. |</p>
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<tr>
<td><strong>SREE NARAYANA GURUKULAM COLLEGE OF ENGINEERING (SNGCE), ERNAKULAM DIST., KERALA (REGION-VII)</strong>&lt;br&gt;Mr. TP Srinivasan, Prof. Dr. Rajkamal and Prof. Dr V Vijayakumar</td>
<td><strong>07-08 March 2013</strong>: National Conference on “Computing Technologies (NCCT’13)”&lt;br&gt;The main objective of conference was to motivate and encourage young researchers to know the applications of their work. The scope of the conference included topics such as - computer vision, neural networks, robotics, VLSI, Image processing etc.</td>
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| **TOC H INSTITUTE OF SCIENCE AND TECHNOLOGY, ARAKKUNNAM (REGION-VII)**<br>Dr. Channappa Akki, Mr. Bhadran VK, Dr. Mohan HS, Dr. Shivamurthy G, Dr. KG Mohan and Mr. Manjunath | **18-19 July 2013**: National Conference on “Advances in Computing and Information Security”<br>There were paper presentation sessions and technical sessions on ‘Wireless Technologies – Past to Future’ - Dr. Akki, ‘Cyber Security’ - Mr. Bhadran, ‘Security issues & challenges to improve security of AES algorithm’ - Dr. Mohan, ‘Secure routing and its issues in WSNs’ - Dr. Shivamurthy, ‘Green Chips to Green Clouds’ - Dr. KG Mohan, and ‘Career Guidance’ - Mr. Manjunath. |

Following new Student Branches Were Opened as Detailed Below –

**REGION V**
- **Anurag College of Engineering, Hyderabad**
  “Success and happiness go hand in hand - success is getting what you want and happiness lies in what you get.” With this noble idea Anurag College of Engineering at Aushapur (V), Ghatkesar (M), Ranga Reddy (Dist.) in Andhra Pradesh inaugurated CSI Student Branch on 1st August 2013. Dr. A Govardhan was the Chief Guest. Mr. I L Narasimha Rao participated in the event as the Guest of Honor.

**REGION V**
- **CMR Technical Campus, Hyderabad**
  CMR Technical Campus inaugurated its CSI student branch on Thursday, 11th July 2013 in the presence of Dr. O B V Ramanaiah as Chief Guest and Mr. Rajeev Ranjan as Guest of Honor. Dr. O B V Ramanaiah motivated students to think and work on innovative ideas and explained how these ideologies could be implemented and advised them to use latest trends in technology to implement the ideas.

**REGION VII**
- **Akshaya College of Engineering And Technology, Coimbatore**
  Department of Computer Science and Engineering of Akshaya College of Engineering and Technology inaugurated CSI Student Branch on 17-09-2013. Dr. J Jaya delivered welcome address followed by lighting of the lamp by dignitaries. Dr. K Thanushkodi honoured the chief guest with a shawl and memento.

**REGION VII**
- **Dhirajlal College of Engineering, Salem, Tamil Nadu**
  The inauguration of CSI Students Branch was held on 27.08.2013. Mrs. Archana Manoj Kumar delivered presidential address and Mr. V. Murali Bhaskaran delivered inaugural address. Chief Guest Mr. Y. Kathiresan felicitated the gathering and gave lecture on “CSI Membership Benefits” and on “Your own Identity”.

Please send your event news to csic@csi-india.org. Low resolution photos and news without gist will not be published. Please send only 1 photo per event, not more. Kindly note that news received on or before 20th of a month will only be considered for publishing in the CSIC of the following month.
Congratulations!

Prof. K Poulose Jacob, Senior Life Member CSI and Chapter Patron, CSI Cochin Chapter has been appointed as Pro-Vice-Chancellor of Cochin University of Science & Technology. He has been Professor of Computer Science at Cochin University of Science and Technology since 1994, and has been Director of the School of Computer Science Studies as well as Dean of the Faculty of Technology.

His research interests are in Information Systems Engineering, Intelligent Architectures and Networks. Dr. K Poulose Jacob has published more than 100 publications in refereed journals, conference proceedings, several edited books. He has given invited talks at various conferences in Europe, USA, UK, Australia and other countries, including two SEAARCC events. He has successfully guided 15 Ph.D. students, who now occupy leading positions in academia and industry.

He is listed in the 2010 Edition of Who’s Who in the World® published by Marquis Who’s Who, as the biographical reference representing the world’s most accomplished individuals.

Provision of Financial Grant to CSI Chapters

The scheme envisages supporting weak CSI chapters needing financial support for conducting events for the benefit of members and community. A maximum amount of Rs. 10000 (maximum Rs. 5000 for each event) can be availed by the chapter during this period. Grants will be provided considering the membership strength of the chapter, initiatives for enhancing membership, timely submission of accounts, timely submission of election results etc. Proposals need to be forwarded by chapters within 30 days of conducting the event through the respective Regional Vice President. Format for submission of claim is also given in the below link. For more details, please visit - http://www.csi-india.org/grant-to-csi-chapters

Provision of Financial Grant to CSI Student Branches

The scheme envisages supporting CSI student branches for conducting events at their chapters. An amount of Rs. 5000 (for a single event) can be availed by a student branch during this period. CSI HQ will support an average of 100 events during this period. While grants will be provided on a “First Come First Serve” basis, they will also consider the quality of events and ensure nation-wide distribution. Proposals need to be submitted to concerned chapter within 30 days of conduct of event. Format for submission of claim is also given in the below link. For more details, please visit - http://www.csi-india.org/web/education-directorate/grant-to-student-branch

S. RAMANATHAN
Hon. Secretary

RANGA RAJAGOPAL
Hon. Treasurer

CSI Membership = 360° Knowledge

Your membership in CSI provides instant access to key career / business building resources - Knowledge, Networking, Opportunities.

CSI provides you with 360° coverage for your Technology goals

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Computer Society of India
India’s largest technical professional association

Join us and become a member

I am interested in the work of CSI. Please send me information on how to become an individual/institutional* member

Name __________________________ Position held __________________________

Address

City __________ Postal Code __________

Telephone: __________ Mobile: __________ Fax: __________ Email: __________

* [Delete whichever is not applicable]

Interested in joining CSI? Please send your details in the above format on the following email address. helpdesk@csi-india.org

Dear CSI Members,

Under Byelaw 5.1.1 of the Computer Society of India, the Nominations Committee (NC) is required to invite appropriate groups of members to submit names of Voting Members for considering them for the various elective offices of the ExecCom and the Nominations Committee as well as Chapter Elections.

Members are accordingly invited to submit the names of candidates who are valid Voting Members for the following elective offices:

For the Term 2014-2015 (April 1, 2014 – March 31, 2015)
1. Vice-President cum President Elect
2. Nominations Committee (3 members).

For the Term 2014-2016 (April 1, 2014 – March 31, 2016)
1. Hon. Secretary.
2. Regional Vice-President (Region II)
   Assam, Bihar, West Bengal, North Eastern States and Other areas in East and North-West India.
3. Regional Vice-President (Region IV)
   Jharkhand, Chattisgarh, Orissa and other areas in Western India.
4. Regional Vice-President (Region VI)
   Maharashtra and Goa.
5. National NC-CSI.
   (a) Nominees with pending dues to CSI or
   (b) Where Disciplinary action has been taken or
   (c) Nominees with pending issues with the Disciplinary Committee.

Note-3 The nominee should be a valid member of CSI as of 31st March 2013 and without any dues for the year 2013-14.

*Note-4 As per the Revised Constitution and Byelaws (March 2013) under Article 3-Group of Members Clause 3.1- Regions; any Region having less than 100 voters no Regional Vice President will be elected for this Region; instead the President would take up this role personally. As Region VIII has less than 100 voters no elections will be conducted for this Region for the year 2014-2015/2016.

The last date for receipt of nominations is November 14, 2013.

The proposals must be sent to
The Chairman, Nominations Committee
C/o Executive Secretary, Computer Society of India,
Samruddhi Venture Park, Unit No 3, 4th Floor, MIDC Andheri (East), Mumbai–400 093 with a copy to:
Dr. Rattan K. Datta -Chairman, Nominations Committee
(E-mail: nc2013_2014@csi-india.org)

All election related notices will be published on the CSI Homepage www.csi-india.org. The date of publishing election related notices on the CSI Homepage www.csi-india.org will be considered as the date of publication. As per Section 4.6.4, “The word mail includes e-mail and the word publication includes web publication”.

The proposed dates for various stages of the above elections are:

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<tbody>
<tr>
<td>Call for Nominations to be published on CSI Homepage</td>
<td>07.10.2013</td>
</tr>
<tr>
<td>In CSI Communications October 2013 issue</td>
<td>14.10.2013</td>
</tr>
<tr>
<td>Last date for receipt of nominations</td>
<td>14.11.2013</td>
</tr>
<tr>
<td>Last date for withdrawal of nominations</td>
<td>21.11.2013</td>
</tr>
<tr>
<td>Communication of slate by NC to ExecCom</td>
<td>28.11.2013</td>
</tr>
<tr>
<td>Slate to be published on CSI Homepage &amp; in CSI Communications: Dec. 2013 issue</td>
<td>10.12.2013</td>
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<tr>
<td>E-mail posting of passwords</td>
<td>16.12.2013</td>
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<tr>
<td>Opening election site</td>
<td>16.12.2013</td>
</tr>
<tr>
<td>Last date for receipt of ballots (Internet)</td>
<td>16.01.2014</td>
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<tr>
<td>Declaration of results</td>
<td>21.01.2014</td>
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The dates may be changed by the Nominations Committee, if required - by suitable announcements on the CSI Homepage www.csi-india.org

We would urge all members to register/ update their latest e-mail Ids with the CSI Headquarters. This will allow the members to derive full benefits from Internet Balloting and to take CSI to a leadership Position in showcasing the use of IT for Elections.

Elections for CSI Chapter

As also intimated in the past, Chapter Elections will also be Held simultaneously with the National Elections. Nominations Committees at the Chapters will invite nominations for these positions from their respective members.

There is no need to send Chapter elections nominations to National NC-CSI. A copy may please be sent to CSI HQ., for record.

1. Vice Chairman Cum Chairman elect (2014-2015)
3. Hon Secretary (2014-2016)

CSI Nominations Committee 2013-2014
E-mail: nc2013_2014@csi-india.org
Dr. Rattan K. Datta (Chairman)
E-mail: rkdatta_in@yahoo.com
Prof. H R. Vishwakarma.
E-mail: hrvishwa@yahoo.com
Dr. A K Saini.
E-mail: aksaini1960@gmail.com
CSI Annual Student Convention Hosted by: Visakhapatnam Chapter
(Under the AGEIS of 48th Annual Convention of Computer Society of India)
11th - 12th Dec 2013 Venue: School of Distance Education, Andhra University, Visakhapatnam

Theme: ICT & Critical Infrastructure
Call for Papers & Participation

**Movie Making:**
Email: mm@CSI-2013.org  Cell: 9246615251
Last Dates for Registration : 20-11-13

**Project Expo:**
Email: projex@CSI-2013.org  Cell: 9440123178
Last Dates for Registration : 20-11-13

**Quiz:**
Email: quiz@CSI-2013.org  Cell: 9849510226
Last Date for Registration : 20-11-13

**Workshops**
- Mobile Applications  worksh.ma@CSI-2013.org  
  (9848643443)
- Security  worksh.sec@CSI-2013.org  
  (9440288931)
- Cloud Computing  worksh.cc@CSI-2013.org  
  (9849202645)
- App Dev. in Win 8  worksh.adw@CSI-2013.org  
  (9885196282)

**Paper Presentation:**
Email: pp@CSI-2013.org  Cell: 9292502400
Last Dates: Paper submission : 10-10-13
Intimation to Students: 01-11-13
Registration: 20-11-13

Free accommodation to out station students on First Come First Served

**Sessions / Tech. Tracks:**
- IT Security, Forensics and Cyber Crime
- Big Data & Analytics, Mobility
- Internet Things, Virtualizations
- Cloud & Social Networks
- Knowledge Networks
- e-Governance for Rural Areas
- MES & Automation, Green IT
- Software Engg Processes
- Hardware & Networking
- Bio-Informatics
- Nano-Computing, Artificial Intelligence

**Convention Highlights:**
- 2 Parallel Tech. Tracks
- 5 Tracks Research Paper Presentation

**Registration:**
- Upto 31-10-13
  - Delegate(CSI Members) Rs.6000/-
  - Delegate (Non - CSI Members) Rs.7000/-
  - Spouse Rs.3000/-
- After 31-10-13
  - Delegate(CSI Members) Rs.7000/-
  - Delegate (Non - CSI Members) Rs.8000/-
  - Spouse Rs.4000/-

Last date for Registration : 30-11-2013

**Chief Patrons:**
- Sri AP Choudhary, CMD RINL
- Prof. GSN Raju, VC, Andhra University
- Prof. G Tulasi Ram Das, VC, JNTU-K

**Website:** [www.csi-2013.org](http://www.csi-2013.org)