# IoT Demystified
## Its role in precision agriculture to meet food security

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*The feature in the form of Q&A published below is based on the interaction of Mr. H.R. Mohan, editor of IEEE ICNL with Mr. Amit Saha, after his presentation on "IOT in Agriculture" at the FICCI Digital Disruption and Transformation Summit. Thanks to Mr Amit Saha for trying to demystify IOT and sharing his views on how IOT in Precision Agriculture will be helpful in meeting the challenges of food security for the country's growing population.*

**Can you update us on the transformation that is currently undergoing in the agriculture sector?**

The Agriculture sector is undergoing a dramatic change - what we call the third green revolution. And as I have depicted below, the digital transformation (3rd revolution) has already kicked off and is warming up parallel to the 2nd one.
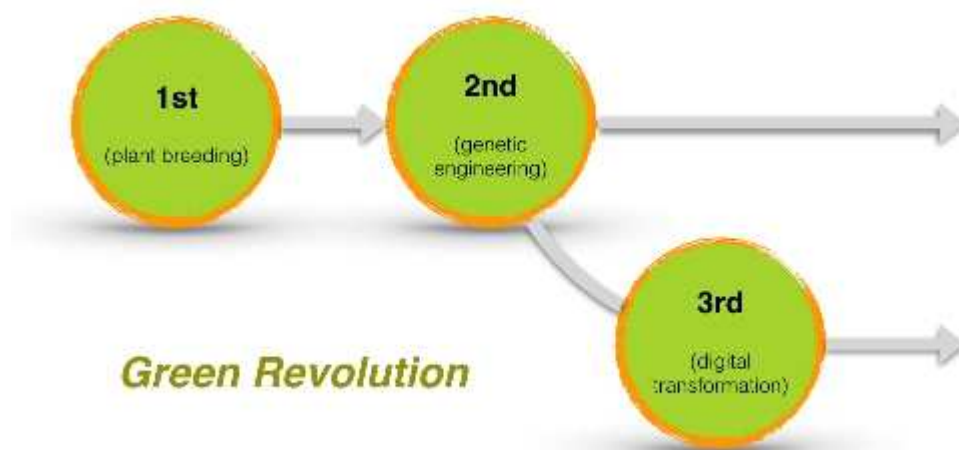


**Do you think IoTs can fundamentally change our life and living?**

IoTs will integrate the online world with the physical world and redefine our life on earth. Let me bring up few scenarios.

Let us consider that you are on a long drive and your car needs a refill within next 12 miles. Typically you will refill at the next gas station. Now imagine that your car suggests you to skip next two gas stations and stop at the third one which is coming up in another 9 miles as that is the station offering the cheapest rate among all the gas stations within the distance that your car can go before it runs out of gas.

Or imagine that a drone flies over a plantation, captures photo and sends to the base station. The photos are then analysed and the system finds few plants having fungus infection. The system identifies the kind of infection and suggests an appropriate fungicide. This information is then sent to the nearest service provider who launches an UAV fitted with spraying equipment and the fungicide and it will spray only those plants that are infected and with appropriate dosage. This will avoid excessive spraying of crops thus helping in attaining zero residue quality as well as reduction of input cost. Payment will be collected digitally from the farmland owner.

## Average Data Usage per User per Month
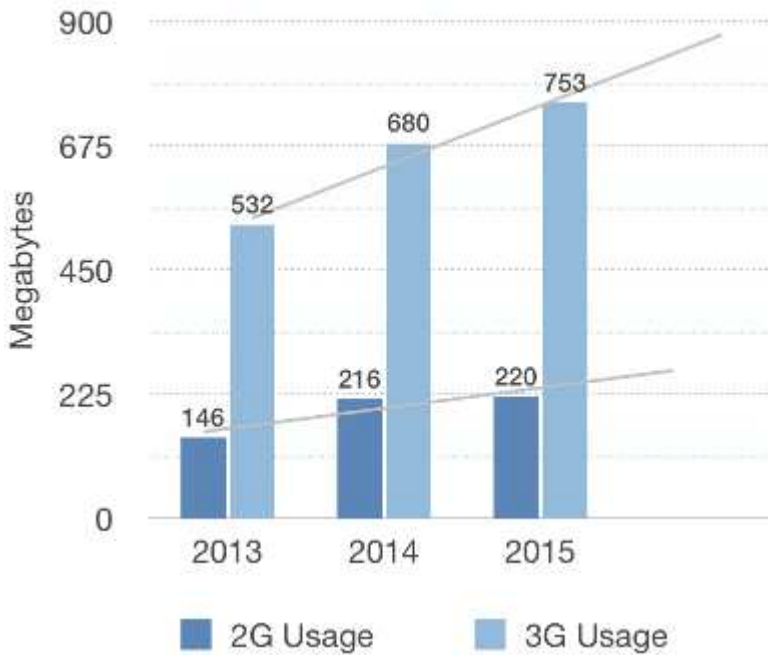


As IoTs are evolving and getting smarter and infiltrating into almost all products and structures, they will generate an unimaginable volume of data. This data can be used to understand the behaviour, identify pattern and suggest best action. This involves processing of volumes of data and analytics will play a key role in this game.

The future machines will be intelligent enough to reconfigure itself to optimise its output. The machines will have sensors built inside to capture key information about their own health and performance and that data will be analysed and used to further enhance output.

And you will see such machines everywhere - home appliances, scanners in hospitals, aircrafts, satellites, construction vehicles, self driven cars, manufacturing plants and assembly lines, sports arena, airport security systems, defence, inside humans and cattle et al.

So, you see that IoT will affect every walk of life and hence completely transform our life on earth.

### How big can this industry grow into?

The IoT industry will explode into a 15 trillion dollar empire by 2030 - that was the estimate from Accenture some 3 years back as well as quoted by Angela Murkell in Davos in 2015.

Typically new technology adoption is slow at the onset. But let us understand that IoT is usually not a complete solution all by itself. IoT is rather an extremely strong enablement for the existing technology. Thus adoption of relatively new technology (and surely upcoming ones) will be accelerated due to integration of IoTs into the solution. The graph below will show you how the shipment volume is on the rise.
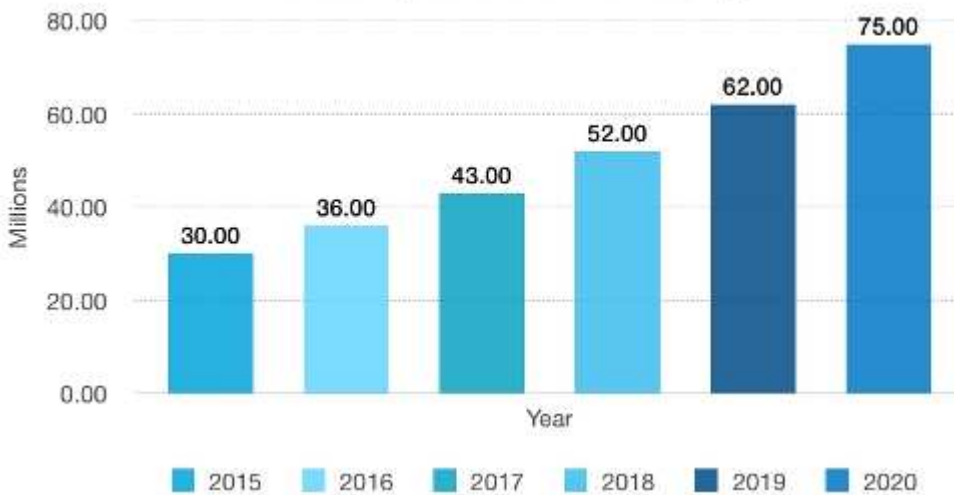


The advent and evolution of IoTs will be like a tide raising all boats impacting sectors including education, medical, tourism, hospitality, agriculture, food processing, banking, retail, aerospace, construction, mining, computer, high-tech and the list goes on.

**What are the challenges in adoption of IoT?**

Like any upcoming technology, IoT has already posed several challenges in technology as well as technology management space. Let me list a few of these challenges:

1.  There are several types of IoT devices and each player has its own way of connecting and communicating with these devices. This is and will lead to evolution of several different approaches each probably optimised to do a certain piece of work by its designer/ manufacturer. This will lead to interoperability issues, vendor lock in, expensive solution, lack of healthy competition and ultimately the customers will miss out on benefit. Clearly we have to arrive at standard(s) that can be embraced by the industry. Surely we will need several standards for different categories of activities, but enforcement of these standards will mature the market and the industry and the customers will enjoy long term commercial benefits.

2.  A problem that lurks over the developing economies is that of availability and reliability of telecom network throughout the country. If this basic infrastructure is missing then the proliferation of IoT technology in developing countries will be severely hurt. There are technology that offer connectivity without utilising the telecom network but we have to wait until such technology really picks up momentum. The industrial network technology like ethernet and wireless technology will double in economic value.

3.  IoTs will generate humongous volume of data. Constant transmission of this data over the telecom (and any other) network, will require massive bandwidth and it is doubtful if existing Telco companies have all the means and financial strength to provide such backbone.



Data Points Generated (and estimated) per Average Farm per Day
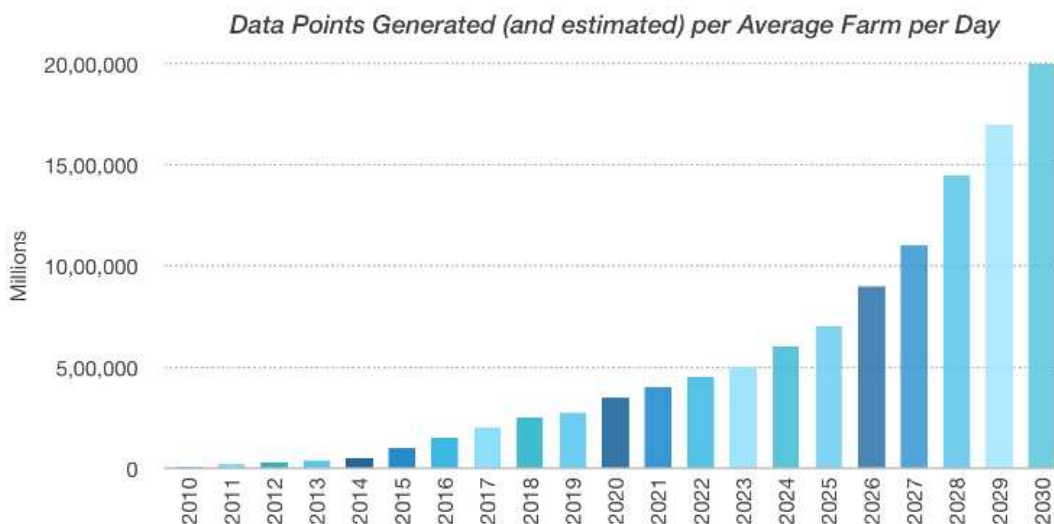
4.  The large data volume generated by the billions of IoTs need to be stored, analysed and acted upon. This calls for hyper capacity computation power and elastic storage that is really unheard of. Petabytes of data needs to be transported, analysed in motion, intelligence extracted and action lined up - all in real time (or in near real time).

5.  Basics of risk management tells us that more the exposure, higher the risk. With billions of IoTs gathering information from external world and transmitting that over a network (mostly public) will surely pose a massive security challenge. Data privacy and security will always be on the mind of the customers when their data flows over public network and all their systems are hosted on public cloud. We need to convince our customers that their data on the public cloud today is probably far more secured than in their own data centres. The industry needs to evolve new security approaches, measures and threat management policies and practices.

**What are some of the areas that you see developing as a part of the big tide that you mentioned?**

We can broadly classify IoT space into four areas/ scope - Connection, Manage, Analyse and Actuate. There is massive development happening within each of these areas.

We will have sensors that will not just be low powered but ones who will never need to be powered externally. These devices will operate on low powered network, will be capable of many to many messaging between large numbers of similar or diverse devices. All these messages will be encrypted which itself poses another challenge. Imagine billions of messages being encrypted, transmitted between thousands of devices and then decrypted at the receiving end for analytical processing - the security processing itself will demand massive computational resource.

The management of this super large volume of data, provisioning of resources, network, storage, security, business continuity will all evolve dramatically and this is already happening. The need for transmitting all data to the central repository will no longer be there thus reducing the cost of data transportation and reducing delay in processing and action.

The analytical software will see radical change in its design and functioning to keep up with the demand to process exabytes of data and drive actions through man and machine on the ground. Traditional Analytics had all the data gathered from the source and then stored on a central storage and then processed through aggregation, slicing and dicing etc. But with millions of IoTs deployed on the field this architecture will change dramatically. The advent of distributed analytics is already changing the game. Data will be stored and processed at the edge without being transmitted to the central repository unless absolutely necessary. IBM Watson platform already offers this feature and is being leveraged in many solutions.

As you already see in previous graph how the demand and need for data is shooting up in India while the graph below will show you how far behind we are compared to data driven society like Japan.



Data Consumption per user per month
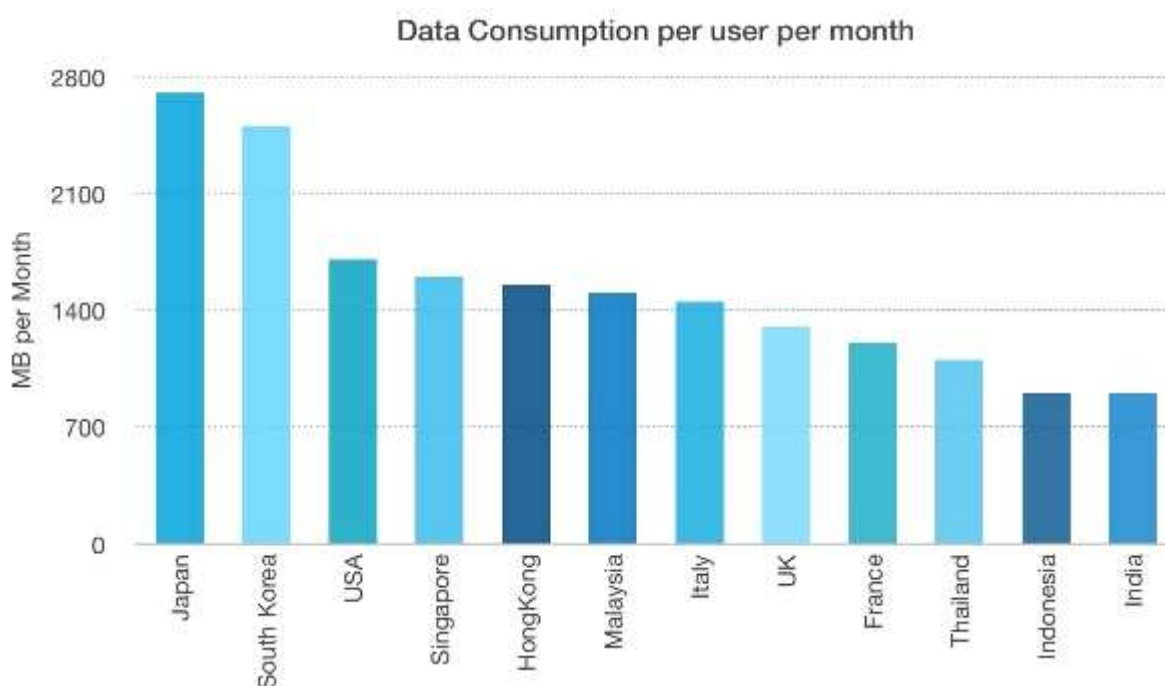
If you see how each one of the large vendors like IBM, Amazon, Google and Microsoft are evolving - they are in a race to provide solution in each of these areas and grab as much market share as possible. There are many smaller vendors who are doing great job in driving this evolution and maturity of technology in the market.

**India being an agricultural country, will IoT help us in meeting the challenges of food security in the years to come?**

I see IoT as an enabler of our food security. Agriculture is one of the toughest sector to adopt IoTs. I see great enthusiasm amongst people to adopt and industry to participate, but the difficulties lie in the complexity of technological implementation as a solution.

Agriculture has so many variables and parameters that are so dynamic that optimising an outcome amongst all these uncertainties is a tough challenge. The change in weather condition every day and hours within a day, rainfall and moisture content of the soil, genetic orientation of the seeds, nutritional composition of the soil, labor availability (non-availability), infestation of disease and pests, regulatory pressure, access to financial and the market for poor farmers - are all challenges that create a complex condition that our farmers have to fight everyday.

We also need to keep the bigger challenge in perspective - to attain food security, we have to double our food production by 2030 on arable land that will reduce to about 70% of what we have today.

So, it is very clear that we can't attain food security if we submit ourselves to mediocre yield - we need the best yield of the most nutritious variety of crops from every inch of land and using minimum of all resources natural or human supplied.

Although these challenges will impede adoption of IoTs, it is probably IoTs that can come to our saving. The practice of precision agriculture is on the rise. As we understand the combinatorial working of the plants, environment and technological systems better and we put them to best possible use in the entire value chain both for the farmers and the ones who handle food thereafter. Such adoption will explode the data generated from these IoTs as shown in the graph below.

Some of the areas of current focus are image processing and recognition, drones, unmanned farm vehicle, robotics, artificial intelligence, predictive analytics, machine learning, gene editing, irrigation, automation and natural language processing.

**About the author**

Amit Saha is an Information Technology expert and a global leader in establishing and managing IT for large international MNCs in North America, Europe and Asia. He is an expert in Envisioning, Strategy, Innovation, Digital Transformation and Organisational Changes. He is a Mechanical Engineer and holds an MBA from National University of Singapore.

He has worked with some of the largest organisations in the world including GE Capital, Dupont, NCR, PwC, Novartis, Pfizer and Syngenta, Amit has established global consulting practices and executed programs in cross cultural environment across Asia, Europe and the US.

He is a distinguished panelist and visiting lecturer to several business and technical schools and delivers on topics including Leadership, Digital Transformation, Change Management, Innovation & Technology Management. Amit is the designer and implementor of several CSR programs for the cause of Multiple Sclerosis, Schools for the underprivileged, Marginal Farmers and recently setup Hunger's End - a social enterprise to feed the hungry kids.

# Dilbert's One Liners

Born free, taxed to death
I say "NO" to alcohol, it just doesn't listen.
A friend in need is a pest indeed.
Marriage is one of the chief causes of divorce.
Work is fine if it doesn't take too much of your time.
When everything comes your way, you're probably in the wrong lane.
The light at the end of the tunnel may be an incoming train.
Everyone has a photographic memory, some just don't have film.
Life is unsure; always eat your dessert first.
Smile, it makes people wonder what you are thinking.
If you keep your feet firmly on the ground, you'll have trouble putting on your pants.
It's not hard to meet expenses, they are everywhere.
I love being a writer.. What I can't stand is the paperwork.
A printer consists of 3 main parts: the case, the jammed paper tray and the blinking red light.
The guy who invented the first wheel was an idiot. The guy who invented the other three, he was the genius
The trouble with being punctual is that no one is there to appreciate it.
In a country of free speech, why are there phone bills?