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for Enterprise Agility…

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UBIQUITOUS TECHNOLOGIES

LEVERAGE OF TECHNOLOGY

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UBIQUITOUS TECHNOLOGIES

INTRODUCTION:

It would be an understatement to say that today's businesses have gone virtual, ubiquitous and unconventional. If the way the modern workplaces are shaping up is any indication, we are not far from a time when conventional work practices would simply go redundant. These liberalized workplaces of tomorrow are focused more on building connections and bringing revenues than attending files and phone calls.

With business activities having become pervasive, making deals and decisions on the go, the sect of 9-5 desk staff is slowly but surely becoming extinct. Smart handheld devices are considered as business supplements than disruptions and work has now come to as close to us as the bed rooms and dining tables. But no one is complaining, because it seems to be a win-win situation where everyone benefits alike.

The key power driving this paradigm shift is perhaps the Technology. Technologies that make seamless switch between meetings and movies or dinners and discussions or e-mails and e-shopping, are helping people to handle work and life like the proverbial two-sides of the coin.

From ubiquitous computing and pervasive networks to connected wearables and autonomous equipment, there is absolutely no place or reason to dodge work anymore.

Agility :

In this rapidly changing world where yesterday's break-through becomes obsolete tomorrow, any enterprise aspiring to be consistently successful and relevant should, in all earnestness, adopt a transformational business approach and position itself to scale up, consolidate, diversify or expand its operations at short-notice.

But agility for an enterprise doesn't come easy or cheap and requires a strong resolve, effective strategy and an extended foresight - a foresight that sees not just what IS imminent next but what MIGHT befall without a warning in the far-future as well.

Fundamentally though, agility is a business, not technology, challenge, yet all too often, tech-centric arguments prevail with posers like - Is agility about business priorities or operational concerns ?, is mobility about devices or applications ?, Is flexible work practice the right approach or is it the regulated one?

The right answers for these are not to be found inside the organization but perhaps in the vast outside world. The technology revolution that is unfolding everywhere will soon be the overriding solution for most of, if not all of, the challenges that are either already here or are yet to confront us.

Various insights offered in this paper into the way things are shaping up around us, would help us comprehend the complexity and magnitude of the challenges

Industrial Revolution-4.0:

Some of us might have a faint idea about the first three Industrial revolutions that the world had gone through since the 17th through 20th centuries, while a few senior citizens might have actually lived through one of them.

From the Steam Engines, through the Industrial Assembly lines to the Digital Electronics, all these manifestations of human evolution are seen as revolutionary because the impact was so profound that they changed the way the world lived and worked forever after.

And now, the world is on the cusp of a fourth revolution, the impact of which will be as profound as the ones before it and is sure to change the world, yet again. Spurred by what is known as Cognitive Computing - or more popularly the Artificial Intelligence – this revolution is considered as an extension of the preceding one, the Digital Revolution, and involves a combination of hardware, connectivity, robotics, and massive mobile computing power, that is unsettling our whole notion of conventional business and work.

1ST IR : STEAM ENGINE

2ND IE : ASSEMBLY LINE

3RD IR : AUTOMATION

4TH IR : ARTIFICIAL INTELLIGENCE

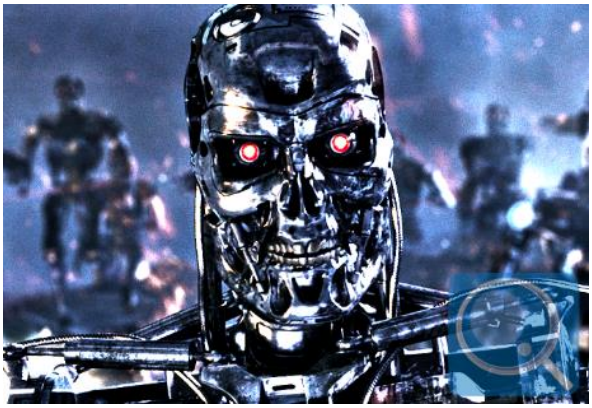


FIG-1: INDUSTRIAL REVOLUTION ↑

Together with Internet of Things and Pervasive Networks which evolved from the Industrial Internet, Artificial Intelligence has already reduced the relevance of human efforts and participation in doing many day-to-day mundane tasks and some high precision jobs too.

According to the Big Data report released in May,2016 by the presidential White House (US), 83% of low wage jobs – that pay $20 an hour or less - in US will soon be automated, potentially affecting 66 million jobs or about 62% of American workers.

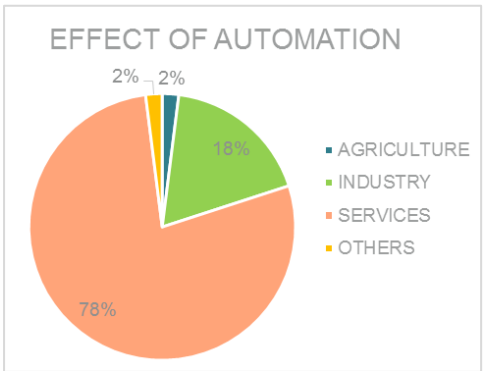


FIG-2: IMPACT OF AUTOMATION ↑

This phenomenon is affecting not just the job market and not just in the US, but governments, businesses and citizens around the world. From higher-education to skilled employment, from industrial production to supply logistics and from citizen services to criminal justice system, every conceivable job that involves gathering, storing, analyzing and action-ing voluminous data at a speed and accuracy like never before is going through this generational shift.

One thing is certain. The way businesses are conducted has visibly changed over the last few years and the nature of this change is dictated by where and how people work and what tools and systems they prefer to use.

CHANGING NOTIONS

The idea of "going to work", which meant going to a static place of work for a specific time duration, is getting obsolete leading to the development of alternative practices that are rapidly replacing the firmly-entrenched conventional work culture.

This drift is shaped by the overwhelming demands of the younger generation of workers, who have different expectations from those of their older colleagues. Interestingly, this Generation Y - those born between 1981 and 1999 and who are expected to be all over the workplaces in the next decade or so - doesn't have 'work' and 'life' per se, they just have 'life'. And everything else for them should fit into that life.

For the employers, on the other hand, a person's physical location has stopped being an important criterion as the focus now is more on the deliverables than discipline. The fact that over 70% of employees of today's businesses are equipped to work from absolutely anywhere has given rise to the new age virtual workplaces like the hives, the huddles, the hubs, the hermits and the hang-outs.

HERMIT	HUB	HUDDLE	HANGOUT	HIVE
▪ Workday	▪ Yammer	▪ Dropbox	▪ Facebook	▪ IM
▪ Outlook	▪ Slack	▪ WebEx	▪ Twitter	▪ Lync
▪ Office 365	▪ Skype	▪ SharePoint	▪ YouTube	▪ Chatter

FIG-3: WORKPLACE TRENDS ↑

These are the workplace trends that are in vogue now and may soon turn out to be the popular work philosophies for every successful enterprise. With lower operational costs, higher productivity and assured employee retention, businesses are increasingly preferring and even promoting these curated work places that have become the ultimate BYOD (Bring Your Own Device) environments.

According to a recent whitepaper on enterprise mobility released by Hewlett Packard, 'Mobility, and being connected, is simply a way of life for anyone born in the new millennium. As these people enter our workforces and become tomorrow's consumers, enterprises must begin to create newer ways to engage them as their customers, employees or business partners'.

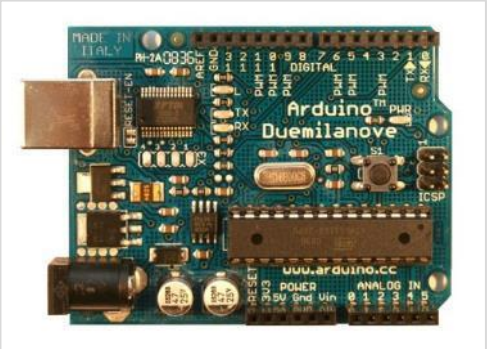
The availability of mobile platforms and applications that enable real people to do real jobs in the real world has prompted organizations to look at new systems of technology engagement, like the ones explained below.

UBIQUITOUS COMPUTING:

As the need for working online anytime and everywhere grows, a new concept of Ubiquitous Computing has taken form. In contrast to the rigid desktop computing, ubiquitous computing can occur using any device, in any location and in any format, thus turning every gadget into a computing device. Ubiquitous computing basically needs five things – portable devices, embedded software, on-demand computing, mobile storage and pervasive networks - to support the new 'work-as-you-like' culture.

Some of the technologies associated with this concept are Firmware, Cloud and Fog Computing and are briefly discussed below:

- **Firmware:** Firmware is like any other Software except that it is stored directly on the ROM of a device to run user programs. It is usually harder to modify or erase this software, hence the name 'firm'.

  Firmware, sometimes also referred as microcode, is typically added at the time of manufacturing, especially the small devices like the smartphones, smart watches and other non-computing devices.

  The ability of the embedded micro-code to act independently on a mobile device, which absolutely has no other processing power, is putting computing controls literally in the hands of the 'users on the move' making working possible in the most unexpected places and ways.

- **Cloud Computing :** Cloud computing, or simply "the cloud," is the delivery of on-demand computing resources over the Internet on a pay-for-use basis.

  Cloud computing is much more than cloud storage though both use cloud-based remote server capabilities. While cloud storage is used to hold data, cloud computing is used to perform specific digital tasks or software activities using the processing power of the cloud servers.

  Cloud computing has huge untapped potential. It allows small and budding enterprises to offer their services, especially the SaaS kind, to a broad audience via an app or a portal eliminating the need to have their personnel physically deployed at the customer's location.

  Fog Computing: Simply put, fog computing is bringing the 'cloud' closer to the end user or the device. When it becomes difficult for the Cloud computing architectures to handle the

communication demands in the near future, when the number of devices is expected to reach close to 25 billion by 2020, then fog computing is clearly the option.

Though cloud architecture works well by itself today, it could fall apart when billions of devices and data transactions get added, through the Internet of Things, to the already crowded computational space.

So, instead of pushing every process to the backend clouds and forcing all inter-device communication through a cloud intermediary, fog computing enables the devices to talk directly to one another when possible and handle much of their own computing tasks when needed.

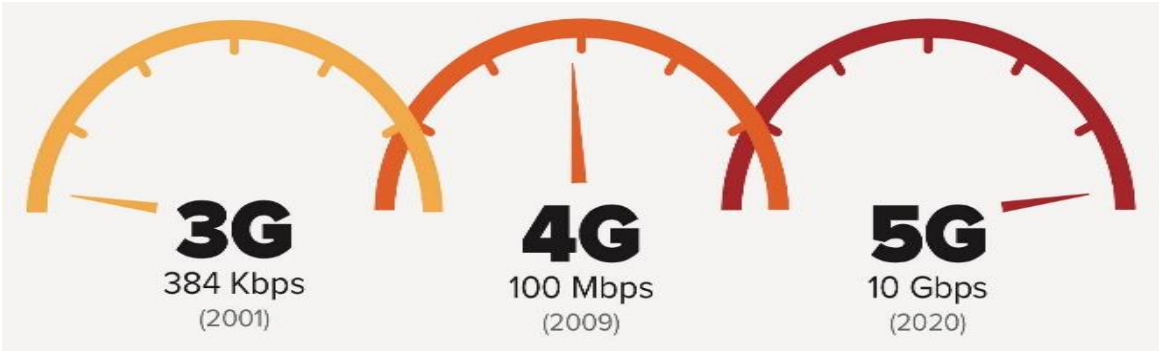
PERVASIVE NETWORKS:

With a growing demand to connect to the internet to support working from any location at real high speeds, advanced technologies including 5G, Wi-Fi, Tactile Internet, IOT and the likes have come in handy for businesses looking for mobility as a perk.

- **5G Wi-Fi & Tactile Internet:** 5G is the newest of technology breakthrough that will put the enterprise mobility on steroids.

  Heralding the Tactile-Internet, 5G will offer simultaneous connections to several hundred thousands of devices over multiple networks at speeds reaching up to 10 Gbps and provide seamless handoffs throughout a geographical area.

  When fully implemented, this 5th generation network technology is predicted to take pervasive computing to the next level boosting the 'work-from-anywhere' culture far and high.



The Internet of Things

Not since the industrial revolution have the commercial and manufacturing industries faced the kind of widespread change that IoT is heralding today, wondering 'how is it that one small acronym wields so much power?'.

As IoT networks enable every object in the physical world to get connected and exchange beneficial information for a variety of

tasks, collecting field information and executing simple commands through bidirectional sensors is enabling data collation, analytics and automation in real-time.

Riding on the Narrow Band (NB) and Low-Range (Lo-Ra) wireless networks and aided by big data analytics, IoT promises to revolutionize public and private services like safety and security, transportation and fleet administration , energy and water utilities, waste and pollution control, traffic and crowd management, supply chain and logistics, precision agriculture and many more.

In a few years, there will be practically nothing in the world that would not be touched upon by Io and Work and Business would not be any exemption.

DYNAMIC STORAGE:

Enterprises and Organizations must learn to support a modern constituency of young and ingenious end users who want to move beyond the traditional silo-ed practices of computing, networking and storage. This generation of restive employees are eager to create flexible, dynamic and responsive work environments and would not settle anything less than a converged IT infrastructure. Advancements in storage capabilities are re-writing the business narrative for the IT and non-IT services alike.

- Flash storage :

We have known 'Flash' as a technology that made all our mobile electronic devices lighter, sleeker and smarter. Invented in early 80's, Flash storage is any storage repository that uses flash memory.

We come across Flash memory in different forms in every day applications. From a simple USB device to the complicated circuit boards in our phones, cameras, MP3 players and most handheld devices, the reach of flash storage is far, wide and complete !

The ever-shrinking Flash has actually took much of the work out of the fixed and heavy desktop machines to the lighter devices on the go, making business travel and site visits more productive and giving the much needed fillip to the enterprise mobility.

- Cloud Storage :

Every business today uses cloud in some form. Though by now widespread, the online data storage on a remote server called 'cloud' is in constant transition. From storing, synchronizing and sharing files - anywhere and any time - to enabling virtual collaboration and seamless workflows, cloud platforms are turning into simulated workplaces of the world, demolishing the established notions of work and workplaces.

According to Net App, the California based Storage and Data Management company, Multi-Vendor Hybrid Clouds and Software Defined Storage (SDS) systems - which are expected to make data management less risky, much simpler, easier and possibly cheaper - are the trends to watch out for that will change the face of enterprise IT in unimaginable ways.

WEARABLES:

The new fad of the technology geeks these days is undoubtedly the digital wearables. With the intrusion of Virtual reality, Social media, Digital modelling and the likes into many interesting aspects of the business world, being able to be connected constantly, interact in real time and respond instantly gives a sure-shot marketing edge to the ambitious employees on the move.

Wearbales are a big hit in the Project Management, Advertising, Marketing, Manufacturing and Medical Care sectors. With the help of wearable devices like the body sensors, smart glasses and smart watches, service providers are able to not just gather user preferences and diagnostic information but are also able to counsel remedies or persuade buyers using virtual and augmented



reality experiences.

Not limiting to the above, in a new technology breakthrough reported very recently, Scientists at the University of Wisconsin-Madison have created wearable integrated circuits that could lead to a much more connected, high-speed wireless planet.

With the advent of connected wearables, the days of carrying and using multiple tools and equipment to inspect, measure, calibrate and report may be over, which may have profound impact on how certain services are evaluated, allocated and managed.

VIRTUAL REALITY:

Virtual Reality and its close cousins Augmented Reality and Mixed (or Hybrid or Hyper) Reality, aren't just going to be a fad any more. With a real big advantage of total immersion and almost indistinguishable experience from the real world, these weird gadgets with heads-up display have real potential for many industries and businesses beyond the entertainment world.

For an emerging technology with so much capital, attention, new hardware, and potentially large canvas of applications, the media business focus is surprisingly narrow. True, it's more about the technology and hardware than the content at this stage but the possibilities are near infinite.

FIG-4: AUGMENTED REALITY ↑

Tourism, Real-estate, Lifestyle and Automobiles businesses, to begin with, will have much use in either conceiving the product design or improving the marketability of their services, both of which will accelerate the internal capacity building and skill-acquisition activities.

This is not typically the environment a business enterprise wants to be in right now, though. But it's probably a potential area that the business strategists should keep their eyes on and eventually gear up for the deployment, when this technology moves beyond offering just a platform and hardware.

UNMANNED AERIAL VEHICLES:

UAVs Or simply Drones have already started proving their mettle through innumerable applications in many sectors that include construction, mining, surveying, aviation, oil explorations and even military intelligence & operations.

Currently some of the purpose-built Drones – that can be maneuvered and directed autonomously from the ground - can weave a cord into cable-stayed bridges, build high tensile structures, capture aerial views of construction projects, carry out safety audits at oil refineries, survey vast stretches of agricultural fields, execute minor rectifications at inaccessible locations, keep a vigil on a crowd or a sensitive place. And the future possibilities are endless.

All this at a fraction of cost and time that otherwise would have incurred through conventional manual interventions. Looking at the way Drone technologies are developing, time may be running out for labor-intensive engagement in many a businesses.

BUILDING INFORMATION MODELLING:

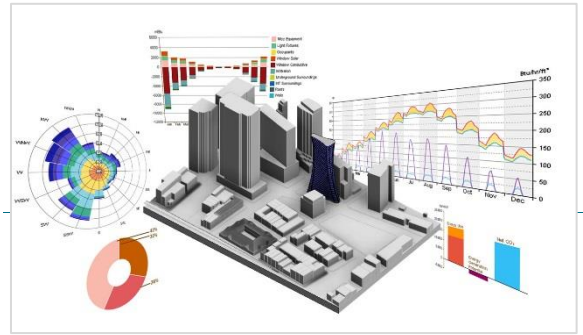


FIG-5: ASSET MANAGEMENT WITH BIM ↑

Popularly known as BIM, this emergent technology is empowering project managers worldwide to directly connect with the enterprise data-base and

manage changes and real-time deliverables on a remote site

For businesses involved in design, construction and operation of Buildings or in delivery, installation, testing and commissioning of engineering services, management of field tasks with BIM and its associated tools has enhanced their performance several notches overnight.

Using various BIM applications, much of graphic information – like the design, drawings and images - as well as some non-graphic information - likes documents, reports and reviews – has effectively moved from desktops to hand-held devices, saving precious resources, time, efforts and reams of paper in the process.

The argument that many of these design, construction and field automation applications may lead to perceptible job displacements may not hold water as such technologies are ultimately enabling high precision data-exchange, error-free installations and speedy deliverables.

AUTONOMOUS VEHICLES:

Finally, the irresistible. The self-driving car is on a roll. Some estimate that in just four years, there will be 10 million self-driving cars on the road. Although it might be more like 20 years before self-driving cars are the new normal, it's important to let it sink in now that it is going to be a game-changer in many ways.

Apart from possibility of dislodging the professional drivers, the self-driving car would also force many other businesses - like Outdoor advertising, FM Radio, Automobile Insurance, Supply chain and logistics, After-Sales Service and more - to buckle-up or go redundant.

But the upside seems to be bright and interesting. Companies may be tempted to either hire or own some of these to help employees get more productive enabling continuity of work stream, in and out of the office.

According to the global management firm McKensey, autonomous vehicles, when fully in use, could free-up up to 50-minutes a day for drivers, reduce parking space needs by millions of square feet and cutting vehicle crashes by 90%.

Personally, it makes a whole lot of a difference to the employees as they turn their energies to more enjoyable and productive tasks. With semi-autonomous features already on offering in some of the popular models, driving may be a real luxury soon.

TECHNOLOGY USE-CASE :

A simple use-case matrix based on the current development trends, summarizing the technologies discussed above, is presented below which clearly envisages that in the next 15 to 20 years, a whole lot of activities in a typical enterprise would need Cloud-Computing, IOT and 5G Wi-Fi services to survive in the industry and other technologies for maintaining a competitive edge.

While Automation, Artificial Intelligence, UAVs and Autonomous Veicles may take a little more time to get into the main-stream business applications.

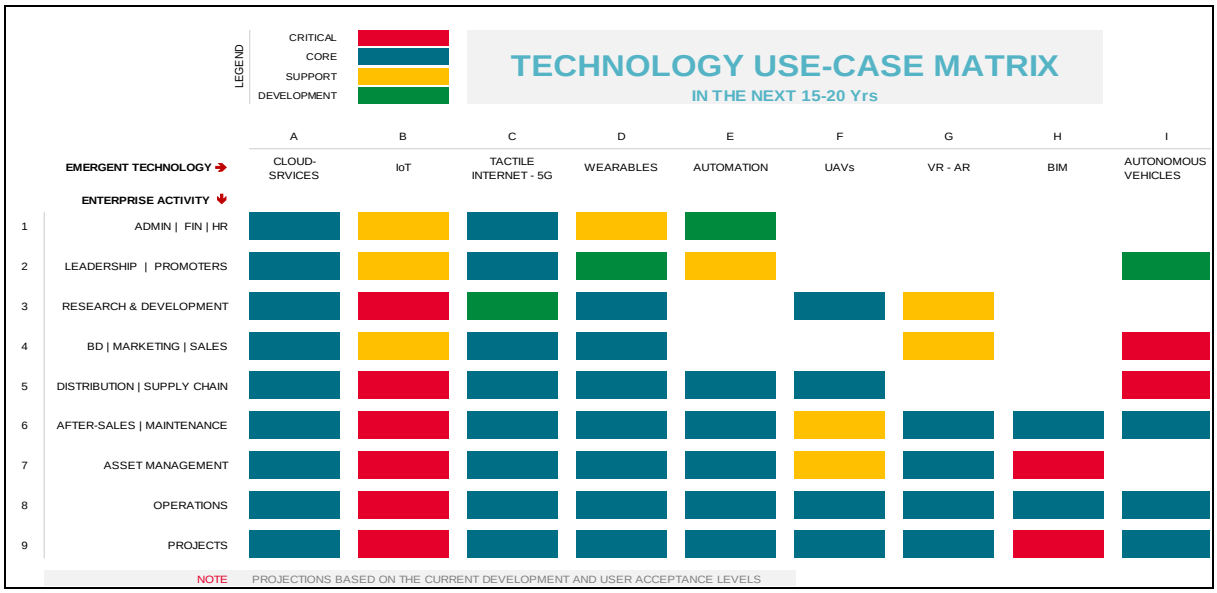


FIG-6: TECHNOLOGY USE-CASE MATRIX – 2030 ↑

CONCLUSIONS:

A recent study by IBM highlighted the strong correlation between innovation and business results for organizations, with future-ready technology-driven agility improving productivity and profitability by close to 40%. The study also found that, IT consumerization is forcing enterprises to keep up with the mobile work-style demands.

Though some of the new technologies, like the Internet of Things, are at or near the peak of the 'Hype-Cycle' for the Emerging Technologies, published annually by the American research firm Gartner, few other trends like the wearables are already on their stable journey to consolidation and deployment.

It is by now clear that no enterprise would be content with the status quo anymore, simply because you can't get the kinds of results clients and employees would expect with the existing conventional

tools for complex business deliveries. To attempt these without using tech-tools would probably be construed not as ignorance but as negligence.

As the paradigm shift in the concept of work is changing the way businesses are operating, it is also upsetting the established theories of productivity and profitability. Agility, Efficiency and Ubiquity are, therefore, the new models of a successful business that will prevail over conventional practices for some time to come.

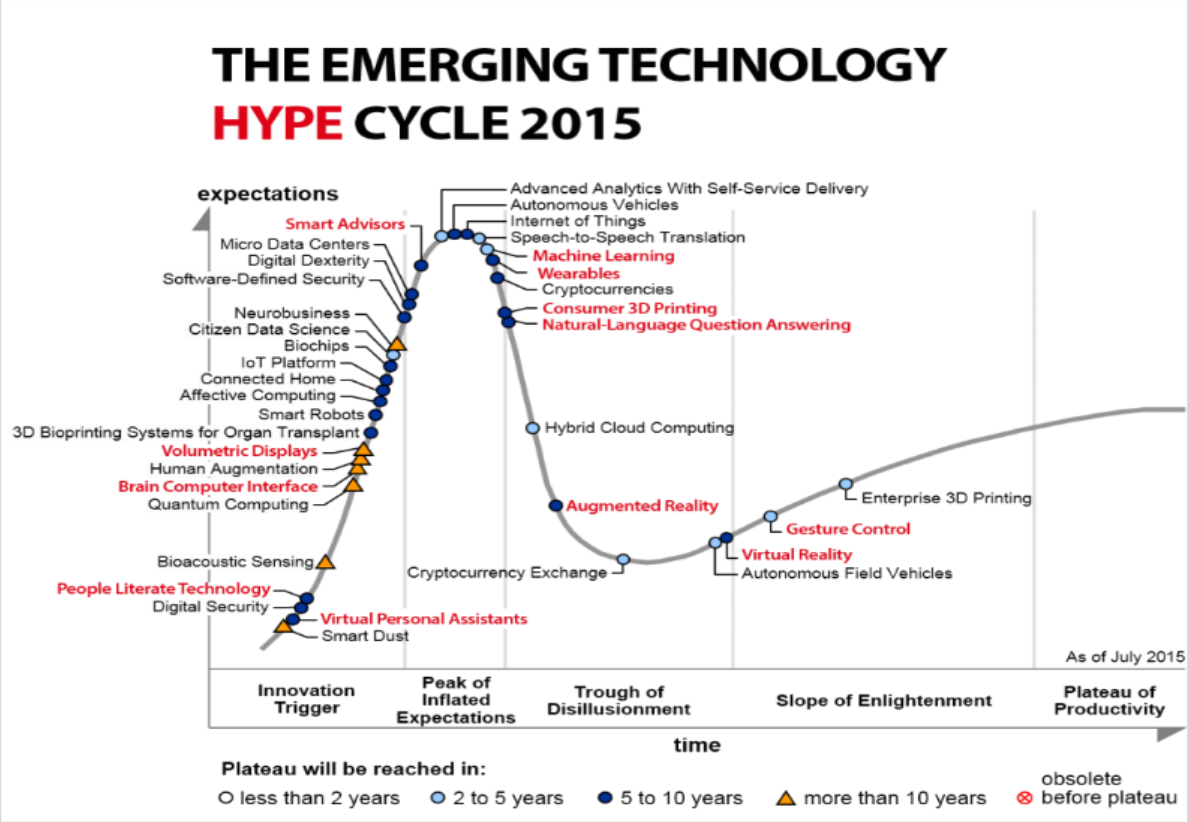


FIG-7: GARTNER HYPE-CYCLE-2015 ↑

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Gautham has also been actively associated with Green and Smart Building Projects for over a decade and has keenly pursued technological advancements in the Building Industry including Building Information Modeling, Lean & Integrated Project Delivery, Corporate Sustainability and Smart Campuses, Communities & Cities.

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- Authored a comprehensive book " Green Homes – Efficient, Healthy & Smart" in 2008 - launched at the CII-Green Building Conference, Mumbai.
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- Presented Papers and spoken at 25+ industry fora on several topics including Green Homes, Building Information Modelling, Virtual Design & Construction, Sustainability Management Systems, Green Computing, Smart Buildings, Sustainable & Smart Cities.