Recent Trends in Information Technology: An Insight from Industrial Perspective

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Abstract
We are in the 'Information Age'. With high penetration of Internet, gadgets, smart phones and usage of web applications like facebook, Twitter, Whatsapp, etc., the utilization of Information technology and Information Systems is in the rise. The term 'Information Technology' encompasses all technologies used for accessing, compiling, organizing, storing, and distributing Information. These technologies include Communication Technologies, Internet, Robots, Cloud Computing and so on. Adoption of Information Technology in various business sectors like Banking, Healthcare, Retail, Manufacturing, etc., are showing an increasing trend. Some of the recent trends in Information technology include Big Data, Business Analytics, Cloud Computing, Internet of Things, Artificial Intelligence, Virtualization, 3D Printing, etc., Some of the popular companies offering IT Solutions include IBM, Amazon, Salesforce, Microsoft, Google, etc., This paper enlightens the recent trends in Information Technology from an Industrial Perspective.

Keywords*: Big Data, Business Analytics, Cloud Computing, Internet of Things, Artificial Intelligence*

Introduction

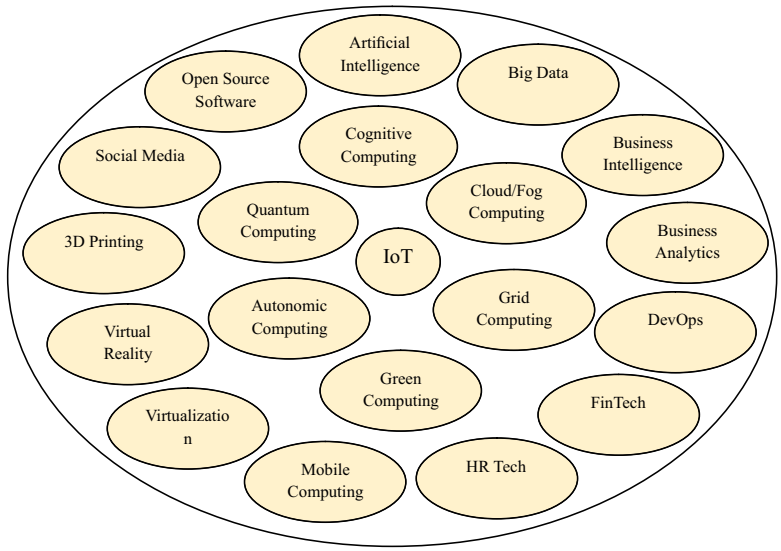
The Business Environment is very dynamic and highly competitive. Digital way of doing business is the current trend and Information Technology (IT) plays a pivotal role in making this happen. Information Technologies are ubiquitous today. Right from big multinational companies to micro and small businesses, the usage of Information Technology is pervasive and is omnipresent. Lot many are happening in the world of Information Technology and its impact on government, research institutes, business enterprises and educational institutions are soaring over the past several decades.

It can be said that Information Technology helps improve efficiency, brings connectivity 24*7, provides convenience, bridges the distance barrier, enhances decision making, advances communication and business collaboration, provides seamless information, brings transparency, enhances ease of use and helps in better corporate governance. One of key IT Trends in the recent years is the impact of Artificial Intelligence. Automation of low-skilled works has impacted several industries. Other key trends include Cloud Computing, Business Analytics and Mobile Computing, Internet of Things (IoT), FinTech, Fog Computing and so on.

This being the current scenario, a paper enlightening the recent trends in Information Technology will help us to get an understanding on these technologies, thereby enabling us to get equipped for the present and the future. This paper focuses on providing insights on twenty one IT Trends which are transforming the world.

Recent Trends in Information Technology

The following diagram provides a snapshot on the recent trends in Information Technology.



Artificial Intelligence

Scientist's eagerness and drive to build computers that can simulate human thinking is the seed to the development of today's modern Artificial Intelligence Systems (AIS). Father of AIS – John McCarthy coined the word 'Artificial Intelligence' way back in 1955 [1]. Recently, the impact of AI is seen in all industries - Courier Drones, Self Driving Cars, Robo Advisors, Cooking Robo's are some of the facets of AI [2]. Some of the companies involved in the development and advancement of AI to the next level include Google, IBM, Intel, Microsoft, etc., [3]. Most of the companies have setup separate R&D Centers for the advancements of AI [4][5][6].

Big Data

With high usage of social media applications like whatsapp, facebook, twitter and easy accessibility of mobile devices like smart phones, tablets, ipads, etc., sharing and availability of unstructured data has increased tremendously. This has resulted in the generation of huge data named Big Data [7]. Gartner refers to this phenomenon as 3V's – Volume, Velocity and Variety [8]. New methods of analyzing Big Data has evolved which are helping businesses to take effective decisions, improve operational efficiency and enhance customer satisfaction [9]. Some of the companies working in this space include SAP, Dell, GE, etc., [10].

Business Intelligence

The term Business Intelligence (BI) was coined by the father of BI – Howard Dresner in 1989 [11]. The fundamental purpose of Business Intelligence is to provide an Infrastructure for the warehousing, integrating, reporting and analyzing data coming from the business environment.

Business Intelligence helps accelerate and improve decision making, identify market trends, spot business problems that need to be addressed, etc., [12]. The leaders in developing BI Solutions include Tableau, Microsoft, IBM, SAS, Qlik, etc., [13].

Business Analytics

The first step in helping companies to make data-driven decisions is building the infrastructure and collecting the required data, often referred as Business Intelligence. The next step is Business Analytics which deals with analyzing the collected data employing statistical and data mining techniques to predict future business trends [14]. Business Intelligence provides standard reports, dashboards, scoreboards and answers the question - *what happened*? In contrast, Business Analytics helps to answer the question - *why it happened*? *Whether the same thing will happen again*? Business Analytics focuses on future and helps in better decision making and planning [15]. Some of the Indian based companies on Business Analytics include Mu Sigma, Fractal Analytics, LatentView, Global Analytics, etc., [16].

Virtualization

In order to reduce IT Infrastructure expenses and also maintain agility, companies have started adopting Virtualization – the process of simulating hardware with multiple operating systems and applications on a single server. This helps companies to reduce the number of servers which thereby helps minimize cost [17]. Some of the companies offering solutions include VMware, Cisco, MicroFocus, etc., [18].

Virtual Reality and Augmented Reality

In today's modern world, Virtual Reality (VR) and Augmented Reality (AR) find their applications in Sports, Entertainment, Architecture, Medicine, etc [19]. Virtual Reality refers to 'Near Reality' and Augmented Reality adds virtual components as a new layer of interaction with a real world [20]. Both VR and AR is computer generated environment that helps improve user experiences. Some of the companies leading their way in VR & AR include Samsung, Google, Microsoft, AMD, Nvidia, etc., [21].

3D Printing

3D Printing is highly adopted today as it helps to reduce cost, improve personalization, build imagination, etc., [22]. 3D Printing is an additive manufacturing process of making three dimensional objects from a digital file [23]. 3D Modelling software is used to create the 3D model in a computer. Some of the companies dominating 3D Printing market include 3D Systems, HP Inc, ProtoLabs, Stratasys, etc., [24].

Social Media/Digital Marketing

With high penetration of mobile gadgets and accessibility of Internet for low cost and its availability 24*7, Social Media has become an integral part of day to day life. Social Media is available in various categories like Social Media Marketing, Social CRM, Social Media Optimization, Crowd sourcing, etc., [25]. Prominent Companies in this space include facebook, twitter, google+, LinkedIn, etc., [26].

Open Source Software

Open Source Software is preferred by people as it provides control, helps in providing training, it is highly stable and secure [27]. With Open Source Software, the source code is available free for customization [28]. Open Source Community promote Open Source software as a means of sharing, collaboration and embracing failure as a means of improving [29]. Some of the companies involved in the advancement of Open Source Software include Adobe, Cloudera, facebook, Google [30].

Cognitive Computing

IBM defines 'Cognitive computing Systems that learn at scale, reason with purpose and interact with humans naturally [31]. Cognitive systems are self-learning systems that use machine-learning techniques to perform specific human-like tasks in an intelligent way' [32]. These systems exhibit characteristics such as Adaptive, Interactive, Iterative, Contextual and Stateful, [33]. Companies focused in this area include IBM, Google, Microsoft [34].

Cloud Computing

According to NIST – National Institute of Standards and Technology, Cloud Computing is defined as on-demand network access to a shared pool of resources. [35]. The advantages of Cloud Computing include reduction in capital expenses, Scalability and flexibility, reliability and improved productivity [36]. Cloud Computing is available in three deployment models - Private, Public and Hybrid models [37]. The three cloud services include 'Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS)' [38]. Leaders in offering cloud platform include Amazon, Microsoft, Salesforce, Google, etc. [39].

Green Computing

Developing and delivering environmental friendly products and services has been identified as one of the important aspect of sustainable development [40]. Green Computing advocates the same and it refers to the practices and technologies for designing, manufacturing, using and disposing of computers, servers and associated devices to minimize impact on the environment [41]. In this regard, Bureau of Energy Efficiency (BEE) – a statutory body is formed under the Ministry of Power in India [42]. The standards are ready for adoption by Manufacturers Association of Information Technology [43]. Top Green IT Vendors include Fujitsu, Dell, Symantec, Qualcomm, etc., [44].

Autonomic Computing

Autonomic Computing is one of the latest trends and it refers to the computer's ability to manage itself automatically through adaptive technologies [45]. IBM has formulated 8 conditions to define an Autonomic System [46]. These systems have ability to get updated automatically, protect themselves from Viruses and alert operations, etc., [47]. Companies like IBM, Microsoft and HP have started working out strategies for Autonomic Computing [48].

Grid Computing

The idea of using 'an idle computing resource for processing useful tasks' is the seed to the development of Grid Computing. Grid Computing connects geographically distributed

computers into a single network to process tasks [49]. The advent of Internet has boosted the concept of Grid computing to be made possible. Grid Computing gives cost savings, improves speed and agility [50]. Examples of companies adopting Grid Computing include IBM, Charles Schwab, HP, etc., [51].

Mobile Computing

Mobile Computing is the current trend in computing as tablets, smartphones, netbooks, ipads, etc., have become the primary means of accessing the internet. With availability of high speed 4G Wireless Internets for accessibility and cloud for storage, mobile computing has emerged as the normal day to day way of computing. Some of the companies in this space include Amazon providing Kindle – ebook reader [52], Apple's iPhone, iPad, Blackberry, Samsung and other players providing smart phones with sophisticated features, etc.,

Quantum Computing

It is expected that Quantum Computers will be leading the next wave of computers [53]. Built on the principles of quantum mechanics, Quantum computers will be using 'quantum bits' or 'qubits' which can store more than 0 or 1 as they can exist in any superposition of these values [54]. Until recently, Google was leading the race of developing Quantum computers [55] and now is being accompanied with IBM, D-Wave, etc., [56].

Internet of Things

Internet of Things (IoT) is the latest buzzword in the world of computing and it basically refers to an ecosystem of connecting any device to the Internet [57]. It has led to the saying "Anything that can be connected, will be connected [58]". Some of the application areas of IoT include smart city, smart home, connected cars, smart farming, etc., [59]. Some of the companies involved in the advancement of IoT include IBM, Intel, Cisco, Ericsson, etc., [60].

DevOps

Developing Customized Software has undergone phenomenal changes. The software development process has improved a lot over the past several decades. Right from traditional waterfall model till the recent agile model, tremendous improvement is witnessed. Agile Model of Software development emphasized 'quick working software releases' and was focusing only on 'Development' [61]. 'DevOps' is the new methodology which advocates the combination of 'Development' and 'Operations' as a single function [62]. DevOps has numerous benefits like rapid delivery, improved collaboration, enhanced communication, etc. [63]. Some of the companies adopting DevOps include Amazon, Microsoft, Walmart, Netflix [64].

FinTech

FinTech refers to the use of Information technologies to perform banking and financial services [65]. FinTech helps improve efficiency, reduce cost and brings customer satisfaction [66]. Some of the salient financial technologies include Integrated digital banking, Digital payments, Block chain, Cryptocurrency, Alternate lending services, Robo Advisory services, Machine learning, etc., [67]. Some of the companies offering fintech solutions include paytm, paypal, mobikwik, etc [68].

HR Tech

Human Resources Technology refers to the automation of human resource function in organizations [69]. The various HR functions include payroll, compensation, talent management, performance management, benefits administration, etc., [70]. Enterprise Software Companies like SAP, Oracle, Microsoft were offering HR Solutions [71]. Specialized HR Tech Vendors like ADP, Ramco, Workday, etc., [72] have emerged now.

Fog Computing or Edge Computing

The credit of creating the term Fog Computing goes to Cisco [73]. Fog Computing or Edge computing is an extension to cloud computing and refers to the decentralized IT Infrastructure in which data, storage and applications are distributed in the most logical, efficient place between the data source and the cloud [74]. The objective of Fog Computing is to minimize the data transported to the cloud for processing, analysis, storage and improve efficiency.

IT Trends and Companies Involved – Summary

S.No	IT Trends	Companies Involved
1.	Artificial Intelligence	Google, IBM, Intel, Google, Microsoft
2.	Big Data	SAP, Dell, GE
3.	Business Intelligence	Tableau, Microsoft, IBM, SAS, Qlik
4.	Business Analytics	Mu Sigma, Fractal Analytics, Global Analytics
5.	Virtualization	VMware, Cisco, MicroFocus
6.	Augmented Reality/Virtual Reality	Samsung, Google, Microsoft, AMD, Nvidia
7.	3D Printing	3D Systems, HP Inc, ProtoLabs, Stratasys
8.	Social Media/Digital Marketing	facebook, twitter, google+, LinkedIn
9.	Open Source Software	Adobe, Cloudera, facebook. Google
10.	Cognitive Computing	IBM, Google, Facebook Microsoft
11.	Cloud Computing	Amazon, Microsoft, Salesforce, Google
12.	Green Computing	Fujitsu, Dell, Symantec, Qualcomm
13.	Autonomic Computing	IBM, Microsoft and HP
14.	Grid Computing	IBM, Charles Schwab, HP
15.	Mobile Computing	Amazon, Apple, Blackberry
16.	Quantum Computing	Google,IBM, D-Wave
17.	Internet of Things	IBM, Intel, Cisco, Ericsson
18.	DevOps	Amazon, Microsoft, Walmart, Netflix
19.	FinTech	paytm, paypal, mobikwik
20.	HR Tech	ADP, Ramco, Workday
21.	Fog Computing	Cisco

Conclusion

For several decades, Information Technologies were helping businesses to improve their efficiency by facilitating collaboration, enhancing decision making and bringing agility. The recent trends in Information technology focuses on reducing expenses made in IT Infrastructure, enhancing user experiences, automating routine tasks, and improving analysis capabilities and also ensure environmental protection. It is predicted that Super Intelligent Artificial Intelligence Systems will be in gouge by 2025 and we should be ready to witness a world of human-machine interaction as a natural phenomenon.

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