The Internet of Things: Overview & Analysis

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Abstract: Internet of Things (IoT) promises a great future for the Internet where the type of communication is Machine-Machine(M2M). The most important features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. IoT essentially makes virtually anything "smart", meaning it enhances every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. This can mean something as simple as enhancing your refrigerator and cabinets to detect when milk and your favorite cereal run low and to then place an order with your preferred grocer. IoT loses its distinction without sensors. They act as defining instruments which transform IoT from a standard passive network of devices into an active system capable of real-world integration. Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for active content, product or service engagement. IoT exploits purpose-built small devices to deliver its precision, scalability and versatility. Everyone, from consumers to corporates, is embracing the changes brought by the revolution called the IoT. It has changed the world in more ways than we could imagine until a few years back. And the changes and advancements will continue in future as well, in fact, IoT will shape our future. Research on IoT Technology has really gained a fast momentum now-a-days. In this paper, focus has been made to provide an overview of IoT Technology along with its future scenario.
Keywords: Applications, Benefits, Future, Internet of Things (IoT), Smart, Technology, Threats.

1.   Introduction

The term IoT was first coined by Kevin Ashton in 1999. Internet of Things [1, 2, 3, 4] is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with Unique Identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. When things like household appliances are connected to a network, they can work together in cooperation to provide the ideal service as a whole, not as a collection of independently working devices. This is useful for many of the real-world applications and services, and one would for example apply it to build a smart residence; windows can be closed automatically when the air conditioner is turned on, or can be opened for oxygen when the gas oven is turned on.
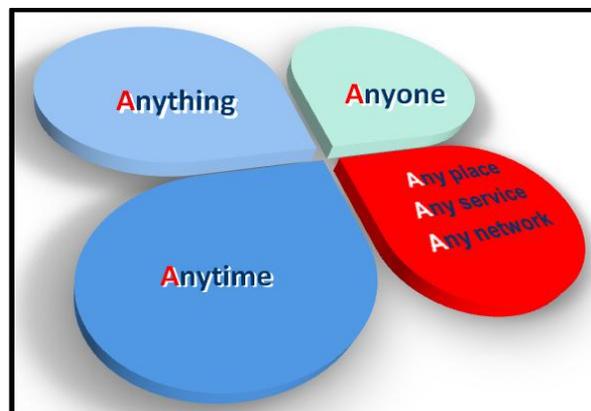

Figure 1: Internet of Things

Internet is already one of the most powerful creations by human being and now with the advent of concept of IoT, Internet becomes more favorable to have a smart life in every aspect. Figure 1 shows the basic idea behind IoT. It shows that with IoT, anything will be able to communicate to the Internet at any time from any place to provide any services to anyone through network. The IoT technology is very much close to implementing smart environments by 2020 [5].

2. Benefits

IoT promises many benefits [7] for an individual, making life easier, safe and smart. Some of these are given below:-

- – Smart Cities
- – Smart/Intelligent Buildings
- – Smart Homes
- – Smart Lighting
- – Smart Cars
- – Smart Health
- – Smart Transportation
- – Smart Parking
- – Smart Environment
- – Smart Energy Management
- – Smart Security and Control
- – Smart Manufacturing
- – Smart Marketing
- – Smart Retail
- – Smart Farming
- – Smart Industrial Control
- – Smart Education
- – Smart Utilities

3. Enabling Life-Enhancing Services

The Internet of Things can enable the next wave of life-enhancing services [6] across several fundamental sectors of the economy. For consumers, connectivity provided by the IoT could enhance their quality of life in multiple ways, such as, but not limited to, energy efficiency and security at home and in the city. In the home, the integration of connected smart devices and cloud-based services will help address the pressing issue of energy efficiency and security. Connected smart devices will enable a reduction in utility bills and outages, while also improving home security via remote monitoring.

In cities, the development of smart grids, data analytics and autonomous vehicles will provide an intelligent platform to deliver innovations in energy management, traffic management and security, sharing the benefits of this technology throughout society.
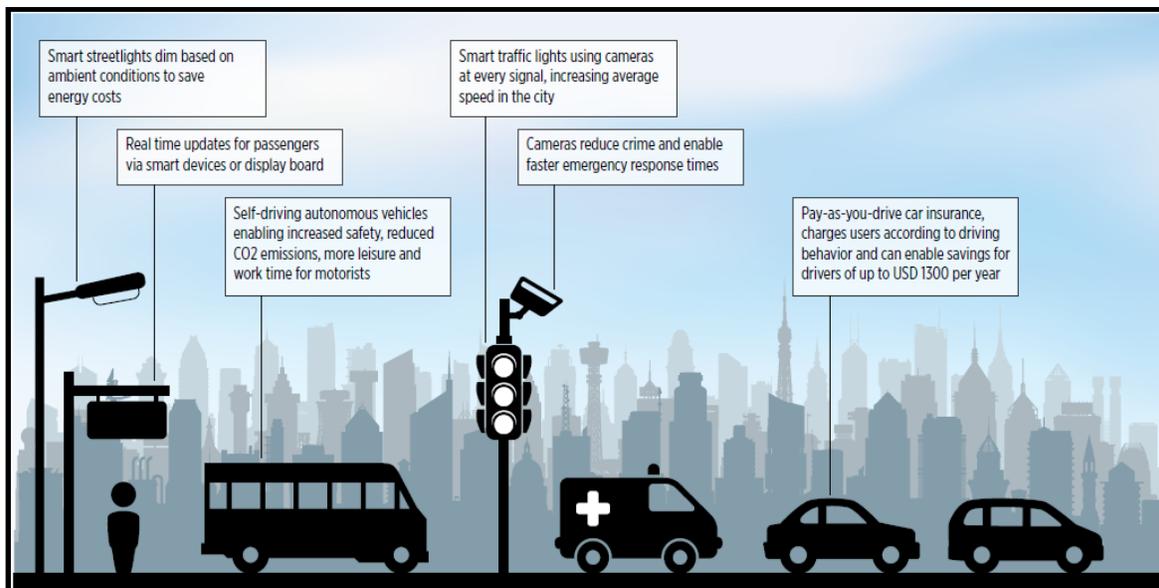

Figure 2: IoT Smart City
Source: McKinsey Internal Research, GSMA

The IoT will also help widen access and improve quality of education and health. As demand for healthcare doubles, connected smart devices will help address this challenge by supporting a range of e-health services that improve access and enable monitoring of chronic diseases and age-related conditions in the home. In doing so, they will improve the quality of care and quality of life for patients, while reducing the strain on the wider healthcare system.
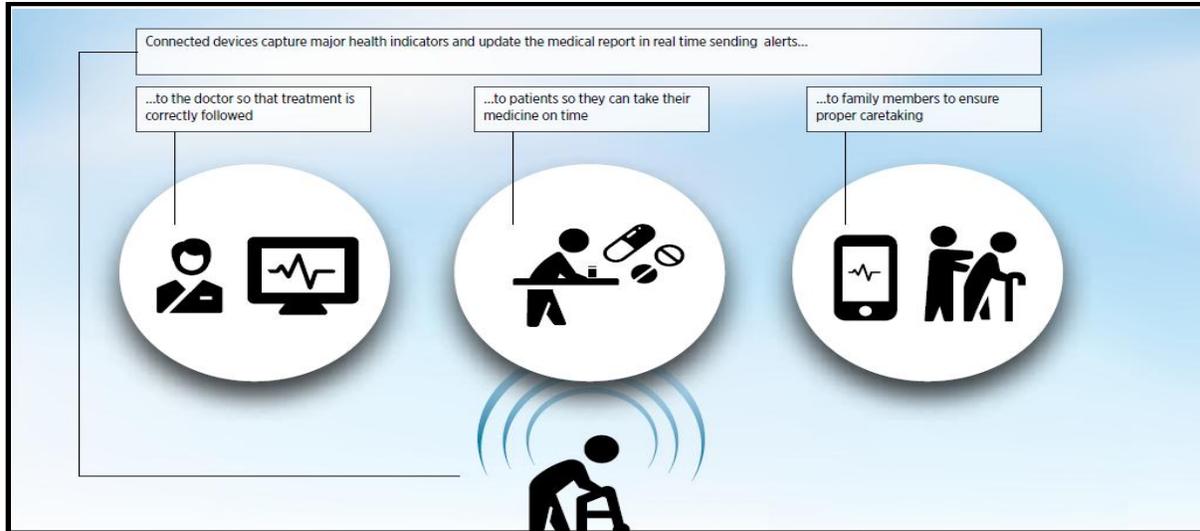

Figure 3: IoT Health Applications
Source: McKinsey, GSMA, 3millionlives UK

In education, mobile-enabled solutions will tailor the learning process to each student's needs, improving overall proficiency levels, while linking virtual and physical classrooms to make learning more convenient and accessible.
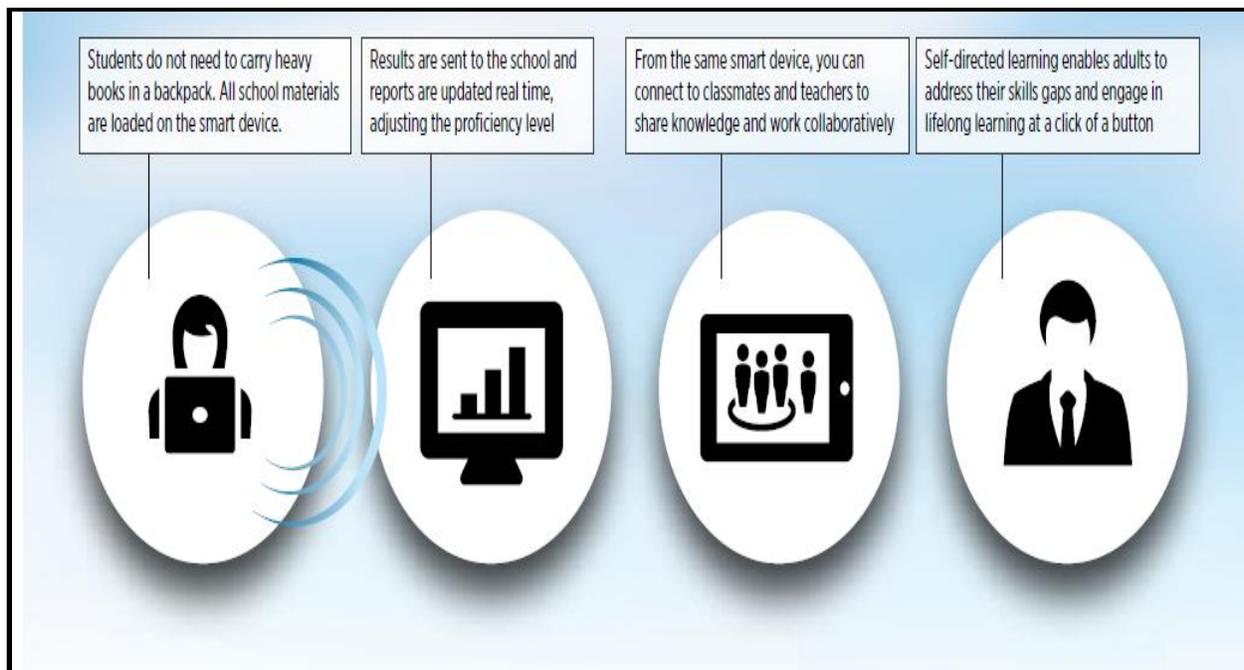

Figure 4: IoT Education Applications
Source: McKinsey, GSMA, Qualcomm, GSV

For enterprises, the ability of IoT to combine innovations in data analytics, 3D printing and sensors, will improve productivity by enabling a step change in the quality of decision making, efficiency of production, personalisation of retail and productivity of food production
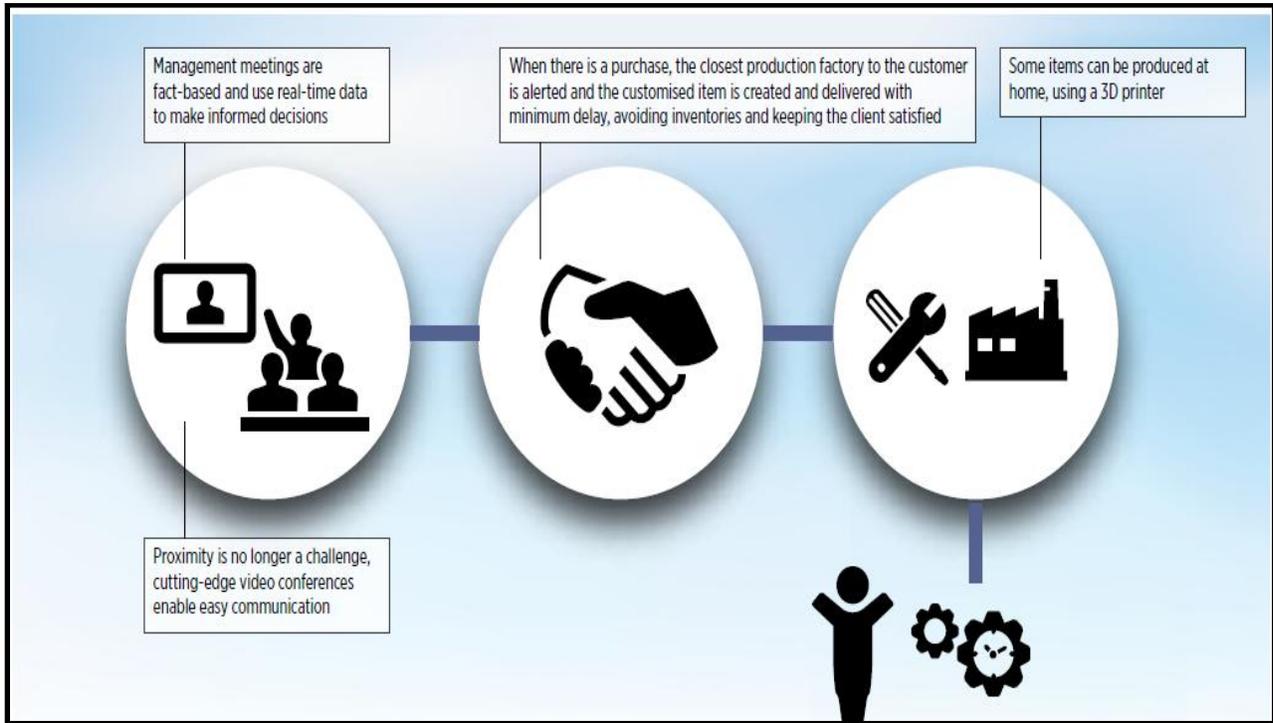

Figure 5: IoT Productivity Applications
Source: McKinsey internal research, CISCO, IDC manufacturing insights
4. Threats

There are numbers of threats [7] with respect to the implementation of IoT technology.:-
–   Sensing a complex environment
–   Connectivity
–   Power Management
–   Complexity
–   Cloud Services
–   Fault tolerance
–   Scalability
–   Self-Organizing
–   Data volumes
–   Data interpretation
–   Interoperability
–   Automatic Discovery
–   Software complexity
–   Delivering Value to the Customer
–   Hardware Compatibility Issues
–   Data Capture Difficulties
–   Analytics Challenges
–   Data Security issues
–   Data Privacy issues
–   Wide range of Regulatory and Legal issues

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5. IoT Forecasts and Analysis
Key takeaways from the collection of IoT forecasts and market estimates [7, 8] include the following:
a) It is expected that by the year 2020, around fifty to hundred billion things will be connected electronically through Internet. Figure 5 shows the expansion of the things connected to the Internet from 1988 and it further forecasts the connectivity up to 2020.
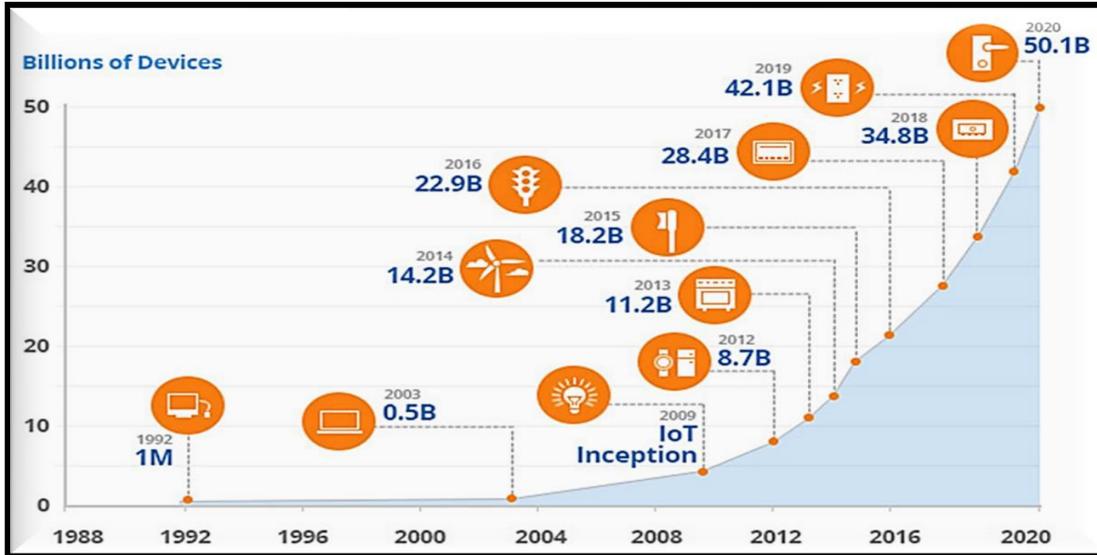

Figure 6: IoT Expansion
Source: World Scientific News, 2017 (PDF, pp. 128)

b) Ericcson is forecasting the number of cellular IoT connections is expected to reach 3.5B in 2023, increasing at a CAGR of 30%. The forecast for cellular IoT connections has almost doubled, due to ongoing large-scale deployments in China. Of the 3.5B cellular IoT connections forecast for 2023, North East Asia is anticipated to account for 2.2B.
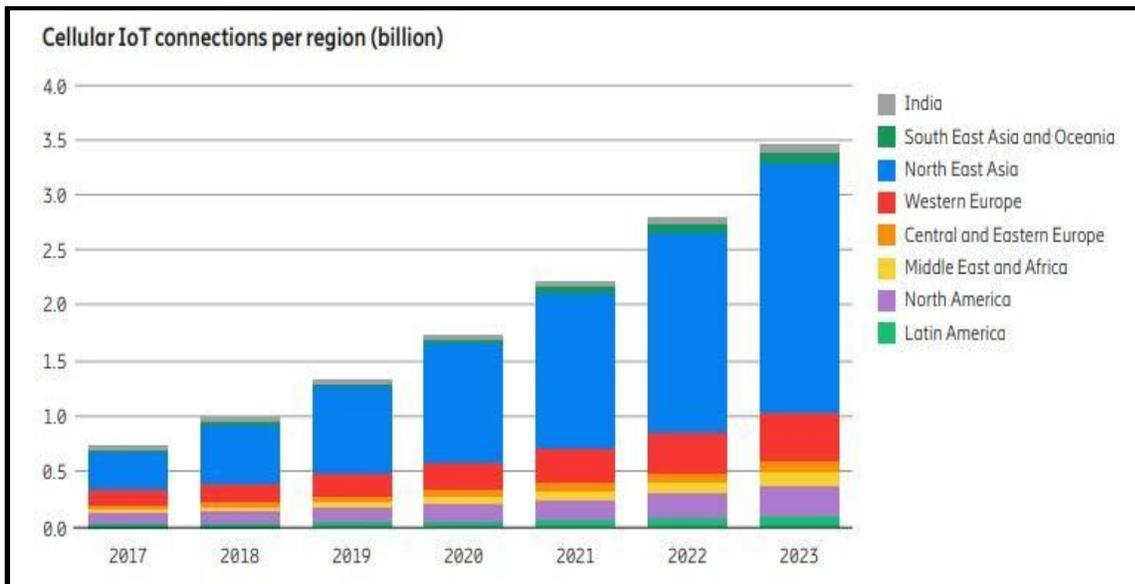

Figure 7: IoT Connections
Source: Ericsson Mobility Report, June 2018 (PDF, pp. 36, no opt-in).

c) IoT Analytics predicts the global market for Internet of Things is expected to grow 37% from 2017 to $151B in 2018. Due to the market acceleration factors, the firm mentions in the cited post, they are revising their forecasts up and expect the market to reach $1.567T by 2025.
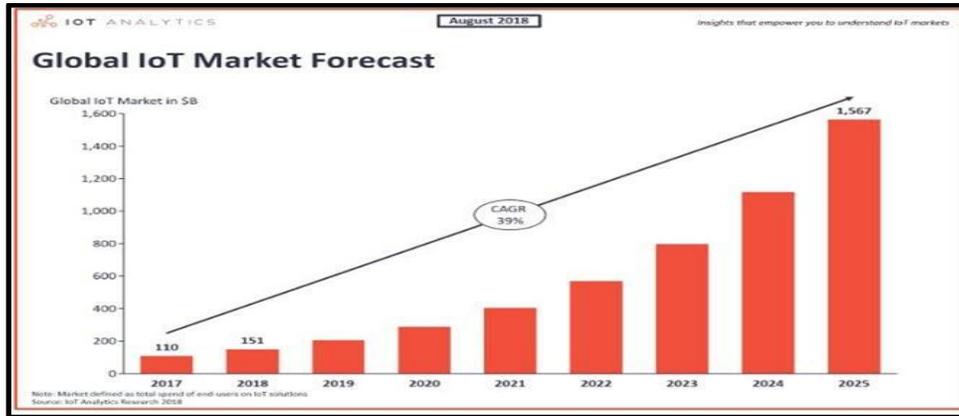

Figure 8: IoT Analytics
Source: State of the IoT 2018: Number of IoT devices now at 7B – Market accelerating. IoT Analytics, August 8, 2018.

d) IoT devices and services will reach an inflection point of 18% to 20% adoption in 2019. DBS Asian Insights is predicting that the IoT installed base will grow from 6.3M units in 2016 to 1.25B in 2030.
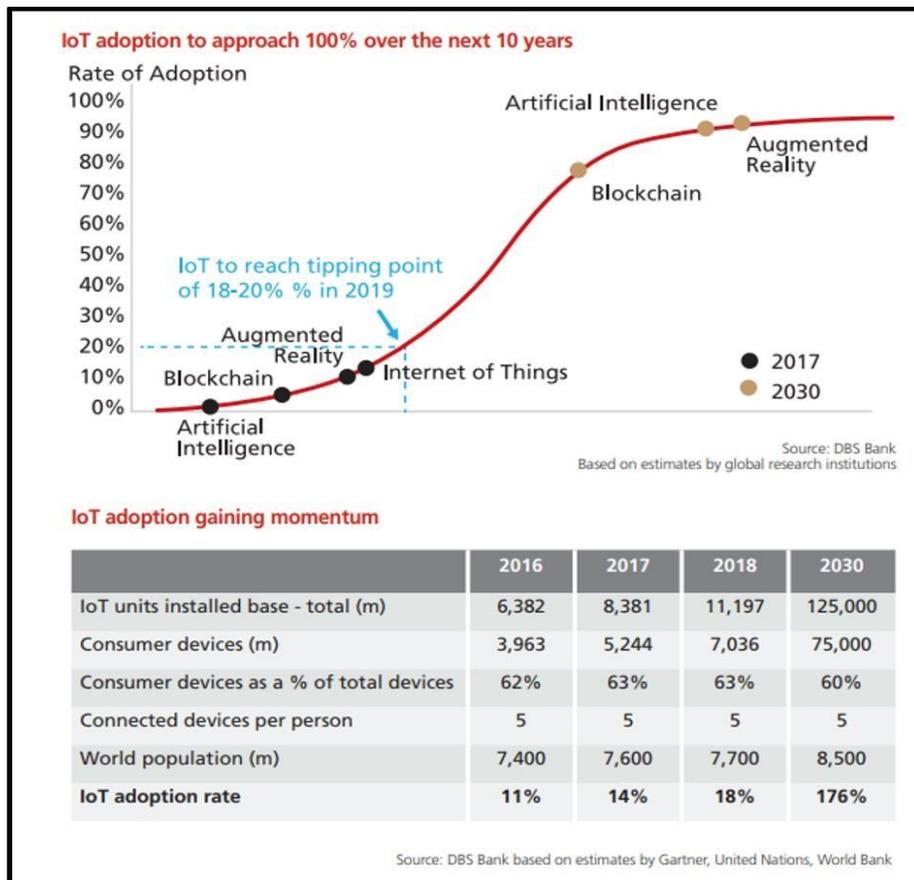

Figure 9: IoT Adoption
Source: DBS Asian Insights, Internet of Things The Pillar of Artificial Intelligence, June 28, 2018 (PDF, pp. 64, no opt-in)

6. Conclusion

The Internet of Things promises to deliver a step change in individuals' quality of life and enterprises' productivity. It is a new technology which provides many applications to connect the things to things and human to things through the Internet. Through a widely distributed, locally intelligent network of smart devices, the IoT has the potential to enable extensions and enhancements to fundamental services in transportation, education, logistics, security, utilities, healthcare, industry, environment and other areas, while providing a new ecosystem for application development. It is hoped that eye-catching benefits of IoT technology will enable industry stakeholders to collaborate more effectively in the larger benefits of clients and society.

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