Product Marketing in the Era of Internet of Things

by

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Submitted to the System Design and Management Program
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Abstract

The Internet of Things (IoT) provides interconnectivity of physical devices with the Internet, allowing it to be remotely controlled by the users. Devices are now able to generate their own content about the usage and operations, providing deeper insights by revealing the hidden patterns.

IoT is affecting virtually all industries and has a tremendous impact on the way we do business, specifically where marketing is concerned. Traditional ways of marketing were revolutionized by Digital Marketing around a decade ago. Now is the time when IoT is going to disrupt the marketing space by providing the access to information regarding how, where, and why the products are being purchased and used.

Marketers would now be able to make data driven strategic decisions to refine their product in order to reduce friction in customer experience. IoT opens up a wide landscape of opportunity for brands to incorporate and respond to customer's need on the real-time basis and target the customers with right message, at the right time at a right place.

Thesis report would provide an overview of the current state of the IoT industry, its technology stack and how a company can make use of the IoT in marketing. The thesis also shed light on different monetization models and pricing models along with the important considerations for designing a strategy for product development and launch. Application of IoT in different industry is highlighted along with example to show how companies have adopted the newer ways to interact with customers.

Thesis Supervisor: Juanjuan Zhang
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Professor of Marketing at the MIT Sloan School of Management

Acknowledgements

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Last but not the least, my husband Chirag, my brother Siddhartha, my parents and my mother-in-law who always stood behind me during the toughest phase of my life to make sure I don't get stumbled upon. Without their blessings and sacrifice, I wouldn't have been able to dream of a Master's degree.

My experience at MIT was nothing less than a roller coaster ride which could have been converted to a scary ride if my SDM cohort had not been there to celebrate every moment including the failures. I truly feel blessed to be surrounding by so many beautiful souls who helped me throughout my journey. Love you and god bless you all.

Dedication

This work along with my whole journey at MIT is dedicated to my charming husband – Chirag (a kingmaker as he calls himself now) and my adorable brother – Siddhartha without whose support and encouragement, I wouldn't have been able to achieve what I achieved so far.

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Contents

List of Figures

List of Tables

1. Introduction

1.1 The Birth of IoT

The term Internet of Things (IoT) is 16 years old but the vision of interconnectivity between everyday devices had been started 47 years ago, at least since the 70s. As the Internet began to gain traction, a number of other terms such as "embedded internet", "pervasive computing", or "Web of Things" came into existence. But the actual term "Internet of Things" was coined by Kevin Ashton, co-founder and former executive director of the Auto-ID Center at MIT, in 1999 during his work at Procter & Gamble (Ashton, 2009). Ashton who was working in supply chain optimization, linked the idea of RFID in P&G's supply chain to the hot topic of Internet to get the attention of executives during the presentation he made. He called his presentation "Internet of Things" which perceived an idea of empowering computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. He envisioned that internet protocols and sensor technology would enable computers to observe, identify and understand the world—without the limitations of human-entered data.

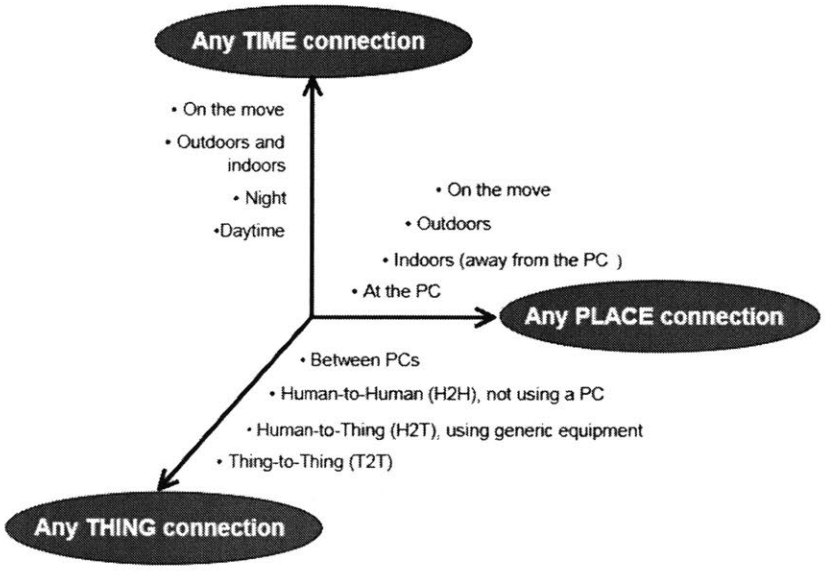

Figure 1 A New Dimension of IoT ("InternetofThings_summary.pdf," 2005, p. 8)

According to the ITU (International Telecommunication Union) Report published in 2005, the Internet of Things brings a new dimension to the world by enabling anytime, anyplace

connectivity for anything using a number of technologies.

1.2 IoT Current Trends

Even though Kevin grabbed the interest of some P&G executives, the term Internet of Things did not get widespread attention for the next 10 years. The internet of things has certainly come a long way since Kevin Ashton coined the term way back in 1999. The concept of IoT started to gain some popularity in the summer of 2010. Figure 1-2 shows the interest of the people worldwide in the topic from year 03, 2007 till date.

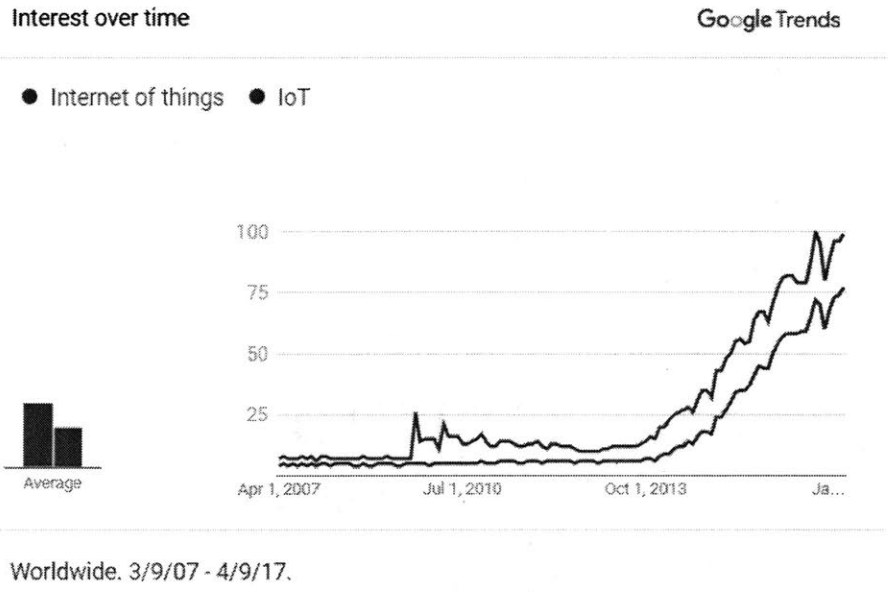

Figure 2 Google Trends showing interest over time across world for IoT

IoT underwent a profound disruption over the past 17 years as there has been a lot of technological advancements which is now available to masses and becoming affordable every year. Due to the recent advancements in the field of Internet, many analysts and technology experts are predicting an almost exponential increase in connected devices. Online commerce boomed as most people became connected to the internet one way or another. As the technology and concept has evolved, the definition of IoT has also evolved during the past 17 years. The below definition represents the conceptual framework of the technology.

Definition: The Internet of Things (IoT) is the network of dedicated physical objects (things) that contain embedded technology to sense or interact with their internal state or external environment ("Internet of Things Defined - Tech Definitions by Gartner," n.d.). The IoT comprises an ecosystem that includes things, communications, applications and data analysis.

Anything that can be connected will be connected with the help of IoT. This will include everything from refrigerators, coffee makers, washing machines, headphones, lamps, wearable devices to much scalable concepts like smart cities, smart grids which will monitor resources like electricity, water, gas etc. for optimum utilization and will make life of the citizens more convenient and hassle free. Fig. 3 shows some use cases of IoT.

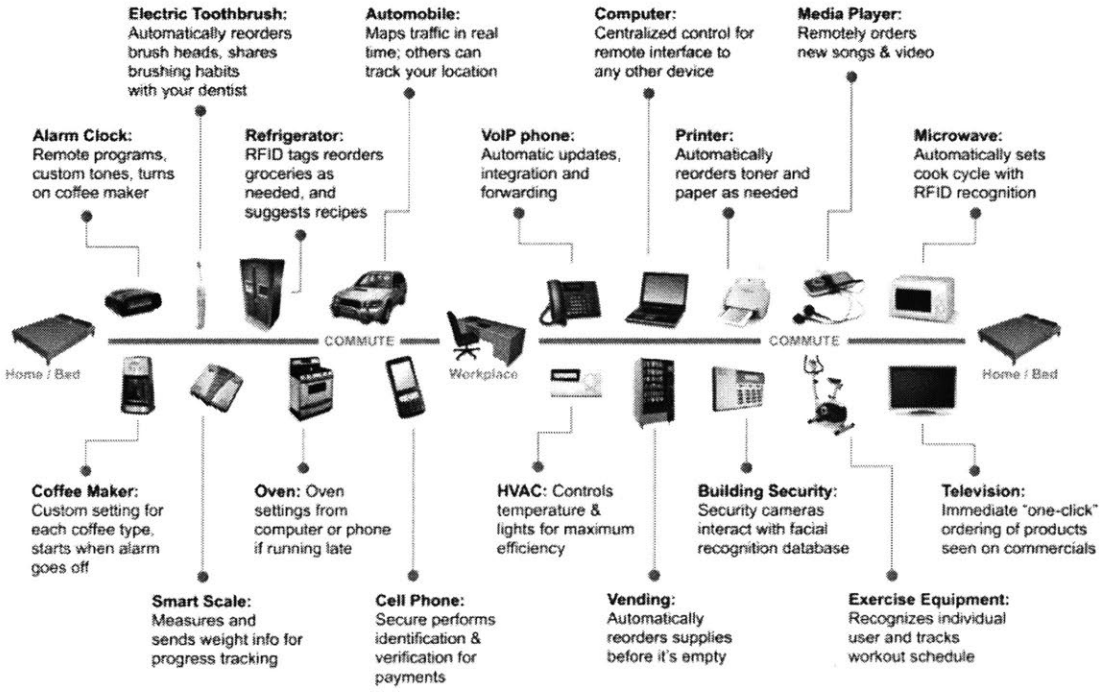

Figure 3 IoT use cases ("Why Aren't People Worried About the Internet of Things Security?," n.d.)

As per the Business Insider report (Camhi, 2016), here are the key points related to the future trend of IoT.

1. By year 2020, it is expected that there will be 50 billion devices connected to internet. IoT devices will account for 34 billion, whereas traditional computing devices (e.g. smartphones, tablets, wearables, etc.) will comprise 16 billion.

2. Revenues from devices, services, and software will reach $600 billion.
3. Companies will spend nearly $6 trillion on IoT Solutions over the next five years.
4. Businesses will be the top adopter of the IoT Solutions. They see three ways the IoT can help improve their market competitiveness by firstly, lowering the operating cost. Secondly, increasing productivity and thirdly expanding to new markets, developing new products and refining existing products with the help of data collected through IoT devices.
5. Government will be the second largest adopter of IoT ecosystem. They will be focused on increasing productivity, increasing efficiency of resource utilization, improving quality of citizen's life and minimizing the waste.
6. Consumers will be buying massive number of connected devices to increase their convenience, safety and savings. They will be going to invest significant amount of money in IoT ecosystem.

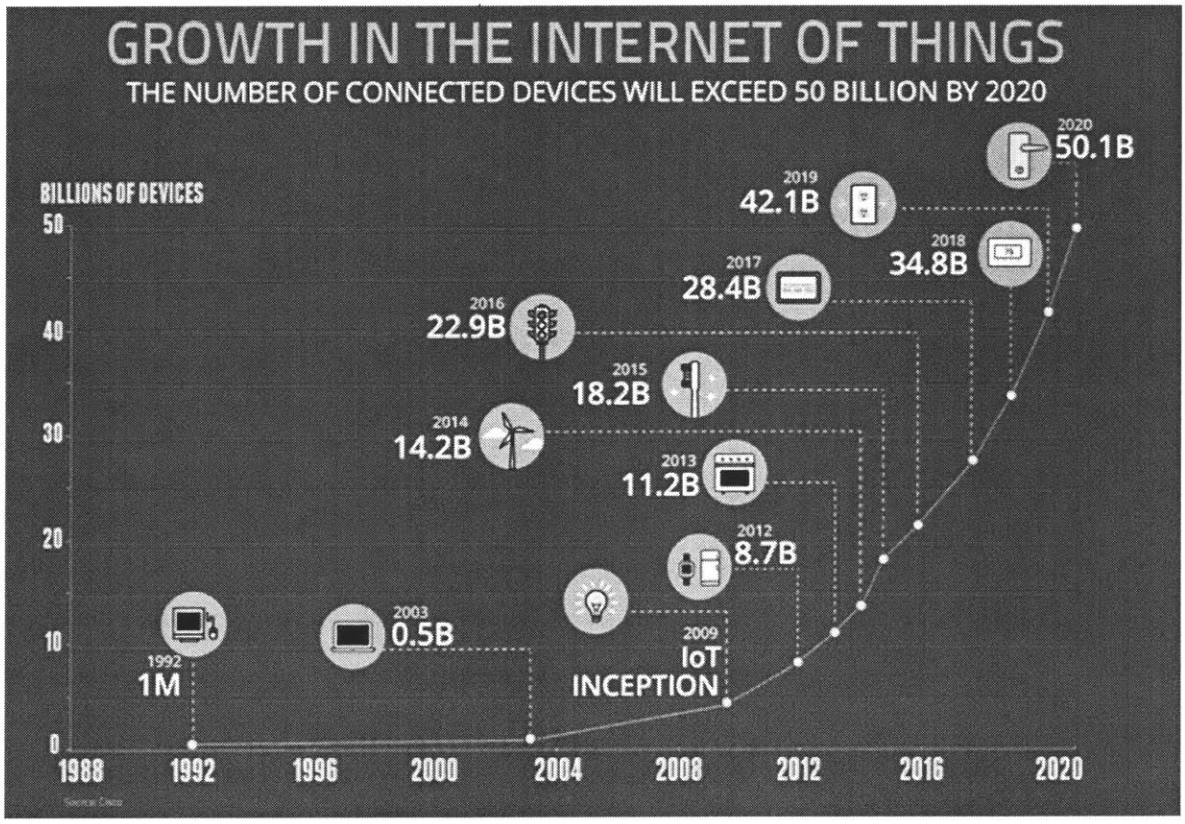

Figure 4 Growth of IoT ("Behind The Numbers: Growth in the Internet of Things | NCTA," n.d.)

1.3 IoT Market Drivers

IoT has evolved massively in the past 17 years and it is not driven by a single concept or technology. There are many factors which have played a significant role in driving the IoT from conceptual stage to operational stage. Below are the few enablers behind its growth.

1. **The cost of sensors and actuator is coming down:** Sensors are the integral part of the interconnected device and enables the device to communicate with the outside world and monitor the environment around them. They act as a digital nervous system which collects location data using GPS sensors, visual and sound data using camera and microphone along with measuring everything from temperature to pressure. The cost of the sensors declined by 50% in the last decade and continue to drop at a steady rate thereby making it easier to integrate with physical devices.

2. **Increase in investment into the IoT:** Companies like Google, Samsung and Dell have invested aggressively in the IoT divisions and continue to invest in the research and development. There have also been acquisitions like Google acquiring Nest, Intel acquiring Basis, Microsoft acquiring Solair, Qualcomm acquiring NXP. The most desirable acquisition targets are companies whose core competencies revolve around data analytics, cyber security, cloud computation, semiconductor chip manufacturing, connectivity platform capabilities and services.

3. **Expanding Internet Connectivity**: According to the reports, currently 40% of the global population is connected to the internet and by 2019, roughly 57% will be connected. The increase in the connectivity will lead to the higher demand and interest in buying purchasing IoT devices.

4. **High demand of smartphones, phablets and tablets**: End users uses these gadgets to control and monitor the IoT devices. With increase in accessibility of these devices at fairly economical price, smartphones account for 70% of the mobile phones and their share continue to increase at steady rate.

5. **Analytics:** With the increase in the processing power of the servers, availability of the cloud infrastructure providing unlimited storage and processing capabilities, advanced user interfaces and visualization techniques, the market for Big Data Analytics has proliferated in the recent years. Companies are investing heavily in deriving insights and taking proactive data driven decisions to get competitive advantage.

6. **Transformation in Business Model**: Through IoT products have become services. IoT enables the product to be used on Pay as you go basis and some customers prefer to pay for the services rather than products. Subscription based usage has been increasing rapidly. One of the good example is enterprise printer services. Enterprises are rapidly moving away from buying printers, toner, paper, and maintenance and instead subscribing for usage-based printer services.

7. **Wireless technology innovation:** IoT inherently means connecting applications and devices that could not be linked previously. Advancements made in high speed mobile communication standards (such as LTE, 4G, and 5G), and low power technologies like LPWAN (low power wide area network), Zigbee, ZLE, BLE are playing crucial role in connecting wide range of hardware devices. Peer-to-peer solutions such as AllSeen, DLNA, and UPnP are also accelerating development; these allow direct device-to-device communication.

1.4 Reference IoT Architecture

It is important to understand the reference architecture of IoT to comprehend the whole ecosystem and to design a go-to-market strategy to leverage maximum benefit out of it. IoT embodies various types of devices, technologies and applications. Hence the industry has become very fragmented and the result is that there is no single architecture which fits for all the requirements. The figure 5 below represents a reference architecture that cover multiple aspects and wide range of applications. Thus, it is inherently vendor neutral and not specific to any set of technologies.

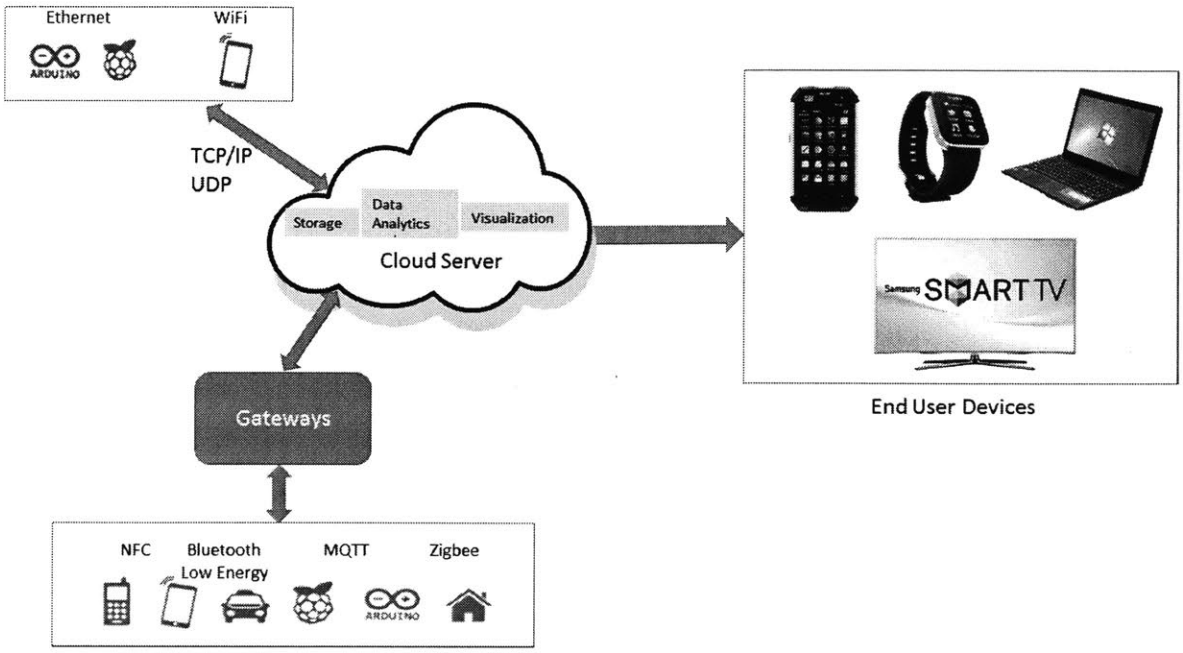

Figure 5 IoT Reference Architecture

1.4.1 Components of the Architecture

The architecture could broadly be divided into four parts as represented in figure 6.

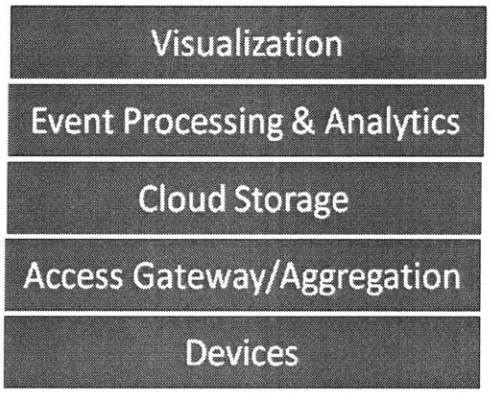

Figure 6 Components of the IoT

1. **Devices:** A device consist of hardware and the software that interacts with the outside world. The most important component of a device is sensors and actuators which sense the environment and converts that into a digital signal. Device could either directly connect to the Internet through TCP/IP or UDP protocol via Wi-Fi or an ethernet connection.

2. **Gateway:** Gateway enables those devices to be connected to the internet which could not directly communicate with the cloud infrastructure. These devices use protocols like Zigbee, ZLE, BLE, NFC to communicate with gateway. A gateway manages traffic between networks that use different protocols. A gateway is also responsible for protocol translation and other interoperability tasks. It receives data from devices and package it for transmission over TCP/IP.

3. **Cloud Infrastructure:** IoT platform could be connected to multiple devices which are generating lots of data on real time basis. Cloud provides an efficient, scalable, affordable way to handle all that information, providing the storage, processing, analysis and visualization through different dashboards. Many companies provide the cloud solutions for the IoT. For example, Amazon, Google, Microsoft and IBM are key players in this industry.

4. **End User Devices:** The cloud connected devices, including but not limited to Wearables, Smart Homes, TV sets, Tablets/Laptop, Voice Assistants are the main user interface for end users to interact with the IoT devices containing sensors. The devices are used to give the commands to the IoT device and in turn receive the acknowledgement.

2. Impact of IoT in Marketing

2.1 IoT: What's in it for a marketer

The Internet of Things is creating new avenues to marketing by providing connected universe full of new possibilities. IoT has a potential to revolutionize the traditional marketing approach which involved old-fashioned styles of knowing customer's needs through survey, paper-based feedback, and media advertisements. The Internet of Things is creating new trends in marketing wherein it would enable the marketers to take an informed data driven decision on the real-time basis.

IoT when executed properly will help marketers to develop and execute campaigns, to structure the team and to optimize performance. It will also provide real time insights of a marketing campaign in terms of its effectiveness and Return on Investment (ROI). With IoT, marketers will have multiple sophisticated tools to answer some the critical fundamental questions about consumers – what, when, how and where. What are customers buying, when are they buying, how are they buying, and where are they buying. To give a better example, a can of beer will have sensors capturing the temperature and location information. Through the data tracking and analysis, the marketer can keep track of every single can starting from the creation till it is consumed by the customer. The data gathered will provide invaluable information related to manufacturing, supply chain, customer behavior and his demographics.

Marketers are required to provide incentives and targeted campaigns to the customers in exchange of their permission to capture the data and to communicate with them directly. For example, retailers will work with OEMs to give you the option to connect your refrigerator to the retailer's mobile app enabling the fridge to add milk to your shopping list automatically when it's out. Retailers will need to provide incentives to customers to get their consent regarding using their device to fetch the data to drive offers.

Thus, IoT will enable multi-way communications between brand and consumer, brand and object, consumer and object, and object and object. To summarize, below are some specific ways in which the Internet of Things will impact marketing:

1. **Consumer Behavior:** With 50 billion connected devices projected by 2020 across the world and with increase in the big data analytics capabilities, marketers will be able to peep into what the consumer is doing, when and where they are buying.

2. **Better Personalization:** Marketers will be able to interact with the consumer on a 'real-time' basis and will be sending them more personalized campaigns. Today, multiple precise indoor location technology solutions can tell a marketer when a consumer has been lingering near a product for an extended period of time, but has not purchased. The marketer can then send a promotional message on the consumer's smartphone to help them make a decision.

3. **Instantaneous Customer Analysis:** Companies providing their IoT platform to the customers like Smart Home kit can collect the data from across multiple devices to get the customer's lateral needs, his/her preferences and behavior. It will help design and promote the lateral sales and the cross-sale opportunities.

4. **Predictive Social Media:** IoT is equipped to use the social communities build on a networking website like Facebook, LinkedIn etc. IoT devices have capabilities to automatically post and share the information on social media and will be able to reach potential customers that may not have previously been contacted. With these better targeted campaigns, marketers will be able to identify and monetize new emerging trends. For example, Toyota's Friend platform allows car owners to interact with their cars, dealership, and Toyota itself by sending alerts when regular maintenance is due. It also allows to communicate with friends and family by connecting to social networks (Toyoda, n.d.).

5. **Customer Feedback:** IoT provides the opportunity for marketers to know the customer feedback instantaneously through various channels. So, if a specific product isn't performing well enough in the eyes of customer then marketers would be able to gauge this feedback much sooner and hence can take corrective action to cut their losses.

    - **Understanding the WHY factor**: Big Data and predictive analytics will help marketer to understand why behind any purchase. This additional insight of why a

customer is buying a product will ultimately improve products, services, and customer experiences and relationships. The answer to why will provide existing usage pattern of the product and will help justify further investments in refining a product.

- **Interconnected Products and Services**: With IoT, different products and apps would be able to communicate with each other using via Application Programming Interface (APIs). An API is a software intermediary that allows two applications to talk to each other. Through the use of APIs, different devices and apps can communicate with each other, resulting in an eco-system of interconnected devices.

2.2 Current use cases of marketing applications through IoT

Digital marketing changed the way marketers promote their brand as it has revolutionized the way people engage with the products. For marketers, the old way of doing business is now becoming unsustainable as there has been a profound change in how customers make a buying decision. Long ago, marketers used the famous funnel model to think about the touchpoints: Consumers would start at the wide end of tunnel having numerous brands and eventually they would narrow down to the final choice. Studies at McKinsey have revealed that with advent of digital marketing and social media analytics, the customer journey has undergone a profound disruption. One popular alternative of the funnel is the **Customer Decision Journey (CDJ)** which is more circular rather than linear.

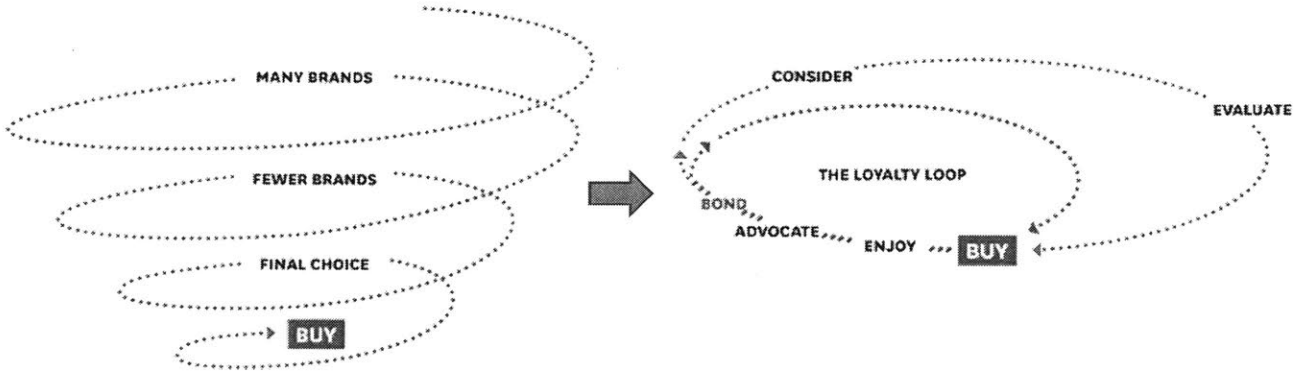

Figure 7 Paradigm shift in the Customer Journey Roadmap (Edelman, 2010)

Figure 7 reveals the new customer decision journey where they add and subtract brands during the evaluation stage and after purchase they remain associated with brand through various media like company website, social media websites like Facebook, Twitter, LinkedIn etc. and take active part in word of the mouth publicity if they enjoyed the product. The evaluate and advocate stages have become increasingly relevant and drive the buying decision of the customer. Consumers today connect with the brand through several touchpoints which are beyond the manufacturer's or retailer's control. For e.g. Most of the customers now use Amazon's website to look for the reviews and ratings provided by the customers before making a buying decision. Digital marketing exploits the advantages of the crowdsourcing and helps customers make more informed decision who use smartphones to make buying decisions just moments before the purchase.

IoT has made the customer decision journey more even more complex by offering new touchpoints to the customers. Though there are few use cases of marketing applications using IoT currently, but it gives us a glimpse about how future of marketing will look like when around 50 billion devices would be communicating to each other.

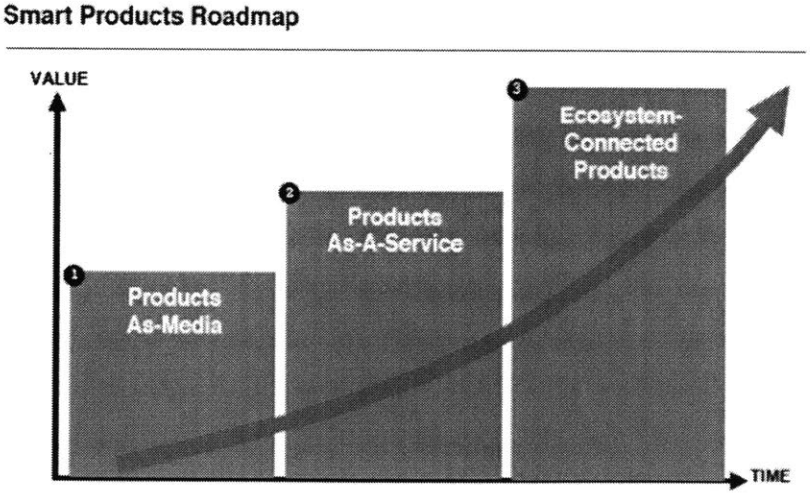

Figure 8 Shift in the IoT paradigm (Allen, 2016)

Figure 8 above shows a shift in the marketing paradigm which is explained using some current applications.

1. **Products as Media:** With IoT, products are able to market themselves which was not

possible before. The product thus becomes capable of speaking for itself and the existing users would be able to promote the brand without much effort as done today. A lot of fitness tracking devices are now a day able to publish the data over the social media about your work out details to get the traction from your network of friends.

- **Apple Watch Series 3:** A real-world example that already exists is apple watch which has the GPS sensor and tracks different parameters i.e. heat rate, walking speed, calories burned, distance covered etc. The product allows the user to post the stats that the watch gathers from a walk/run to their social media, essentially advertising the main benefit of the product to their friends. It increases the impact of advocacy as they not only see users enjoying the product but also how they are achieving their goals using product features. Apart from Apple watch, there is Nike+, Fitbit and other fitness tracking device capable to promoting their features.

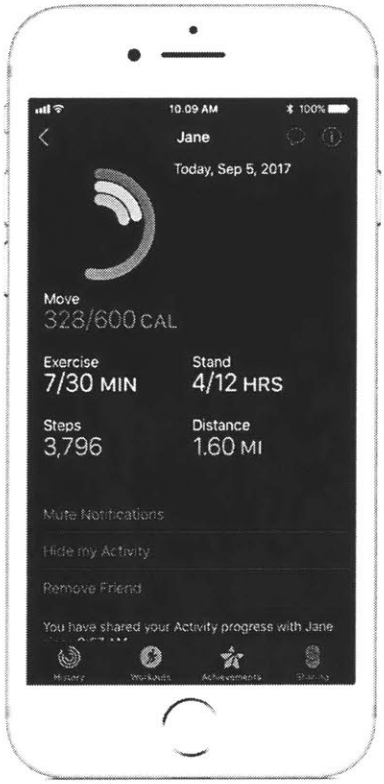

Figure 9 Work out details shared with friends ("Share your Activity with your Apple Watch," n.d.)

- **Diageo:** Products can get a lot more personal when the Internet of Things makes them smart. Diageo whisky used the Evrythng platform to turn bottles into personalized gifts, allowing purchasers to create a customized video for the recipients.

  As a result of the tech savvy campaign, Diageo realized a whopping 72% sales uplift and the cost of the campaign was repaid five times over. Company's spokesperson said that "With Evrythng's technology, we are creating Diageo's first one-to-one marketing platform at point of sale, which means we can engage and respond continuously to our highly-connected consumers by bridging the virtual and real worlds."

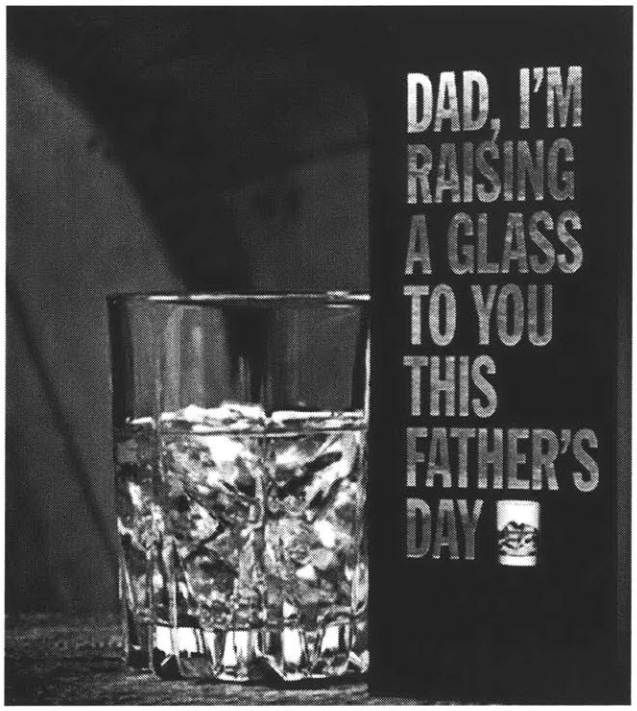

Figure 10 Diageo's marketing campaign for the Father's Day (Allen, 2016)

- **Amazon dash buttons:** Connected products are not only capable of marketing the products but also help drive sales. Amazon's dash buttons connect to your home Wi-Fi and link to the Amazon app. They can be pressed whenever you are running low on a given product- i.e. Tide detergent or any other common household product, and the product the button corresponds to will get delivered. In this way, customer's decision cycle is now being controlled by the brand wherein customers are not even going to consideration and evaluation phase to look for similar products. It also adds convenience and makes the purchase process completely frictionless. In addition to dash, Amazon has

voice assistant Alexa which can book a cab via Uber app or help you purchase items from Amazon.com.

Figure 11 Amazon Tide driving the sales (Allen, 2016)

2. **Product as a service:** Product is a means to provide the service to the customers and companies are now shifting their focus from being a product provider to service provider. IoT has brought a new wave of business model where hard-core OEMs are also positioning themselves as technology service providers. Integration of products and services is not a new concept but IoT has now made it seamless. Below are some examples of how companies are leveraging the power of connected devices to deliver the value proposition.

- **Tesla Motors – Over the air software updates:** Tesla is known for their ground breaking electric car technology. Their cars are also equipped with high end software which is capable of remotely getting updated to provide necessary services. Recently during the hurricane Irma, Tesla remotely sent a free software update to the cars across Florida, extending the battery capacity of their car and giving them the extra range to flee the area. As a result of the update, 75-kilowatt-hour battery pack limited to 210 miles of driving will now deliver 249 miles. The upgrade remained till a fixed period of the time before it was taken back. In future, services like upgradations, maintenance etc. could remotely be provided by the manufacturer to build the loyalty.

Figure 12 Tesla's over the air software update (Allen, 2016)

3. **Eco-system connected products:** IoT provides maximum benefits when operate in the ecosystem. IoT ecosystem providers can leverage the data collected through plethora of devices to get a 360 degree of the customer. The ability to collect and analyze different sets of data in real time provides maximum opportunity to transform the business model and value proposition of the company. APIs play a huge role in building an ecosystem as it enables disparate services to interact with each other and create new connected experience. Below are some few examples which throws light on the IoT ecosystem.

   - **Uber – Spotify:** Through the use of APIs, Uber and Spotify have linked their services so that a customer can link his/her Uber account with Spotify. When taking a ride in an Uber, user can play his playlist from Spotify through the car's speaker. It greatly improves the customer experience and makes them loyal towards the brand.

3. How can companies monetize from the IoT

As IoT is going to disrupt the market in coming years, it has huge implications on the business model of the company. Companies do have to rethink about their corporate strategy and the three dimensions of the business model namely value creation, value chain and value capture. Value creation involves activities which determine the company's offering and focus on maximizing the company's value by enduring customer needs and designing user friendly solutions. On the other hand, Value chain involves activities which determine how the value or the final product is being delivered to the customer. And finally, value capture refers to setting the right price of the commodity to realize maximum benefits.

3.1 Monetization Models in IoT Industry

According to the study conducted by Deloitte of 89 IoT implementations between 2009 and 2013, 65% of the use cases were focused on cost reduction and efficiency, 22% focused on cost reduction while only 13% were targeting revenue growth (Openshaw, 2014).

The key to the sustainability and monetization is having a recurring revenue not just by the sale of the product but by including value added services, subscriptions and data analytics. There are 4 different business models that are emerging as the most promising ones in IoT.

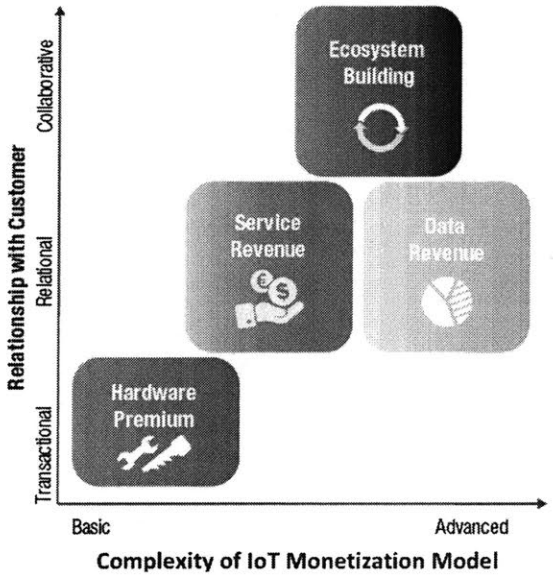

Figure 13 Monetization Models (Bonnet, 2014)

1. **Hardware Premium:** It is the most basic form of the monetization model. Here, Companies add the connectivity options to the new or the existing product which could be controlled remotely from the other devices. This novelty of remote connectivity enables companies to charge the premium for their product. For example, Philips Hue Connected Bulb have capabilities to get connected from phone or tablet via Philips Hue app which needs to be downloaded once. It gives more control to the users by allowing them to change the brightness and the color. It offers infinite possibilities for playing with the colors. It can also connect with Amazon Alexa to receive voice commands.

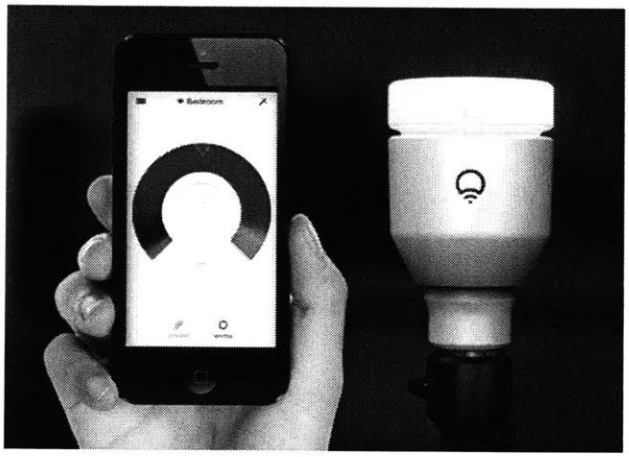

Figure 14 Philips Huelight along with the app. (Hruska, 2015)

2. **Service Model:** In this model, company get recurring source of revenue from the customer in lieu of the services provided based on IoT. This model helps company create a relationship with the customer long after they have purchased the product.

   For example, Volkswagen Car-Net features allow customers to connect their smartphones app to the dashboard screen in addition to providing enhanced navigation, sports scores, weather information etc. It also provides security & service feature like calling for help in event of emergency, checking status of car remotely, automatic crash notifications in case of deployment of airbags etc. All these features are provided for a subscription fee of $17.99/month and $199/year.

3. **Data Revenue Model:** As more devices get connected, they will generate large volumes of the sensor data. For many organizations, the ability the collect, transform and analyze the

data will result in a potential monetization model. Organizations can either sell the raw data or can deliver useful insights based on that.

For example, Michelin, world's third largest manufacturer of the tires launched EFFIFUEL program by leveraging IoT. The company uses the sensors inside the vehicles to collect the data like fuel consumption, tire pressure and temperature, speed and location. The data collected is then processed in the cloud and analyzed by experts to give recommendations related to eco-driving techniques, reduction in total cost of ownership, and reducing carbon footprint etc.

4. **Ecosystem Building:** IoT yields maximum benefits if designed to be use in a connected ecosystem. The bigger the ecosystem, the greater the value generated for all its stakeholders. In an ecosystem, the focus is not on selling a product or a service, but on providing a shared platform to other players in the ecosystem like hardware manufacturers, software developers, service providers etc. In such a model, the platform provider ideally makes money from both end customers as well as other platform users. The end customer pays one time fees to get the platform whereas other platform user pays to the organization for showing up its listing on the platform.

   For example, SmartThings from Samsung offers an innovative smart home solution which consists of a centralized hub acting as the brain of all the smart home devices by other manufacturers. It is compatible to most of the prominent smart home devices like refrigerators, coffee machine, door locks, lights, thermostat etc. and provide the functionality to schedule these devices to make life easier. They can also integrate with voice assistants from Amazon and Google to receive voice inputs. The hub is priced at $99 and many OEM's sells the product which is compatible with Smart hub. Since the IoT market is much fragmented, a product which promotes open ecosystem thrives maximum acceptance by the consumers.

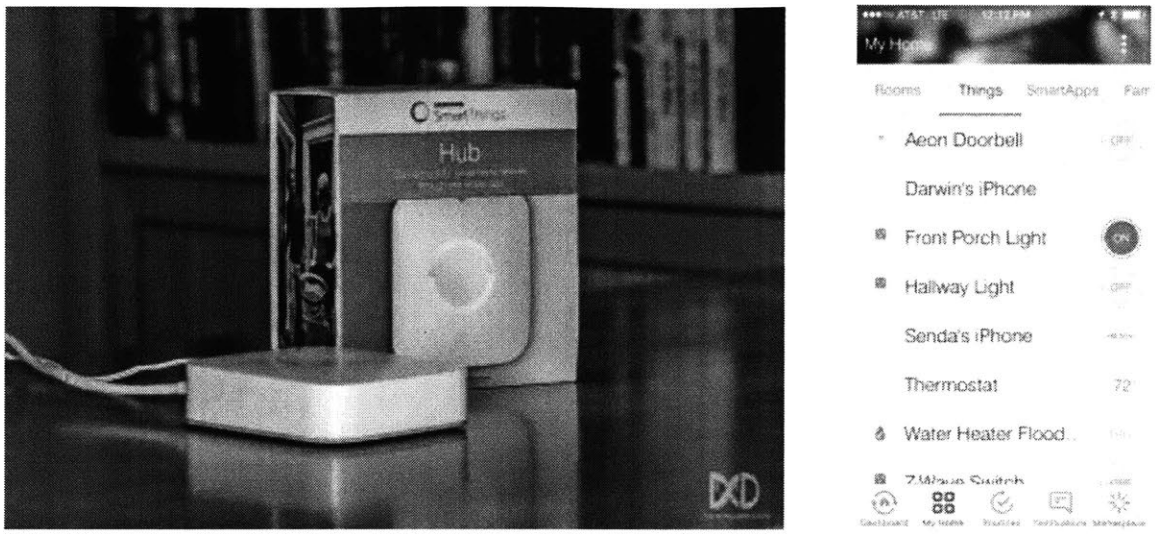

Figure 15 Samsung Smartthings Hub and its interface (Darwin, 2016)

3.2 Pricing Models of the IoT

Pricing is one of the most important aspect which should be considered while launching the IoT product in the market. Getting pricing model right increases the probability of success and acceptance of the product. Below are the few pricing models prominent in the IoT Industry.

1. **One-Time Charges:** In this model, a customer pay one-time fee for the offering. Offering could be provided in the form of either product or services but it is largely used for products having IoT functionality. For example, Nest Intelligent thermostat adjust the home temperatures based on the usage pattern and is controlled with a free app. Customers pay a one-time fee to get the product.

2. **Subscription Model:** In this model, the customer subscribes for the service and have flexibility to customize it in terms of offerings and duration. For example, senior monitoring system called Wellness helps families keep an eye on the elderly through a wearable device which tracks the sleep patterns, eating habits, incidents such as fall, daily activities etc. with a one-time purchase of device followed by $69-$99 monthly subscription.

3. **Pay-As-You-Go Model:** It offers a much more flexibility to users as they need to pay according to the actual usage of the services. For example, Rolls Royce provides the jet engines to the airlines on the basis of per engine flying hours and takes the responsibility of

maintenance and service of engines. With thousands of sensors build inside, Rolls Royce keeps track of the engine condition and use predictive analytics to determine future maintenance. Airline benefit from the reduced operation cost whereas Rolls Royce benefit from increase revenue.

Another example is where Brother (www.brother.com) offer leases for printers without any base price. One would be invoiced only on the pages that are actually printed. It is very attractive for customers as they don't have to spent a huge amount upfront and still get the services.

4. **Pay-for-Results Model:** It allows customer to pay on the basis of desired results they achieve by harnessing the IoT technology. In this model, customers can see the RoI directly and are fully satisfied by the product or services they use. It is also called as 'Outcome-based' model and has been recently added to the business landscape. This model results in the higher engagement with the customer as well as long term relation but on the other side it is more complicated and bit riskier for the companies to execute.

   For example, IoT startup Enlighted offers the intelligent lighting control system which is built on IoT architecture and consists of network of LED lights along with sensors. The system collects data from the environment and takes action on lighting based on real time analytics, increasing energy savings up to 90%. Customers pay them a percentage of money which they save using their technology, without paying anything upfront.

5. **Freemium Model:** In this model, the subscriber is provided with basic services for free so that he gets to know the technology and become acquainted with the process. The advanced functionalities can be made available for a price. For example, netatmo.com provides a smart home alarm system that contains sensors to measure temperature and movement. The basic function of monitoring rooms and sending the message to a smart phone app in case of any intrusion, is included free of charge in the price of the system.

Pricing Model for the Ecosystem

Ecosystem's pricing model could be the combination of the pricing model discussed above

depending on whether customer is using product or the services.

1. Fixed Fee Model: It is one-time fee paid by the customer to use the platform.
2. Transaction based Fee: It is charged by the platform provider for every transaction carried over the platform.
3. Revenue Share Model: Organizations pay a percentage of the revenue in exchange of listing their products through the platform.

Pricing Model	Example	Monetization Model
One-time Charges: Customers pay a one-time fee to acquire the offering.	Amazon sells the Dash button at one-time cost which can order products online.	Service Revenue
Pay for results: Allows customer to pay a percentage of realized benefits.	Enlighted sells the lighting equipment in return for the share of the savings made.	Hardware Premium
Subscription: Customers pay a fixed fee for customized services for a particular duration.	Kaeser, air compressor manufacturer gives cylinder on subscription basis and do its maintenance	Service Revenue
Pay-As-You-Go: Customers pay as per the actual usage of the service	Zipcar provides on-demand cars and charges on the basis of per-use (either hourly or daily)	Service Revenue
Freemium: Customers get offering for free and gets acquainted by the service	Netatmo uses a freemium model to provide home security services.	Service + Data Revenue

Table 1 Multiple Pricing Models with examples

3.3 Key Challenges in IoT monetization

Though the IoT has a potential to generate about $19 trillion of value in coming years as per the recent estimation by Cisco, the market is still in the early adoption stage and suffers from few challenges. As per the recent report by Capgemini (Bonnet, 2014), 96% of the companies said that they would be using IoT in some way in next 3 years, while 68% of the companies have already invested. However, 70% of the organizations have not been able to generate the revenues. Below are the 3 main reasons behind slow adoption rate of IoT amongst the end users.

1. **Security Concerns:** As the devices are becoming more and more connected, there is an increasing threat of the privacy and security. The concerns range from hackers stealing our data and even threatening our lives to companies using personal sensitive data for its own

good. Hackers to aim to breach the system which is profoundly used by consumers and cause widespread inconvenience. Consumers now not only have to worry about protecting their computers and mobile from the spyware attacks but also other small appliances or household device which is connected to Internet and has a potential to be hacked. Hackers could potentially control the car remotely and can accelerate or decelerate it. And could also use your security cameras to keep an eye on the current happenings. One of the recent example of such a cyber-attack which disrupted the Internet service across US and Europe was DDoS attack (Distributed denial of Service). It was largest of its kind in the history which shook the world. The cyber-attack was caused a by a new weapon called Mirai botnet and the victim was the servers of Dyn, a company which controls the domain name system (DNS) infrastructure. The attack brought down the sites like Twitter, the Guardian, Netflix, Reddit, CNN and many others in Europe and the US. DDoS attack infected IoT devices mainly webcams, DVRs all over the world and they become the part of botnet army, causing malicious traffic to Dyn Servers causing it to go down. Customers are becoming increasingly aware about the malicious attacks and are wary of buying the IoT devices, causing a slowdown of the market.

2. **Lack of Standards:** IoT market is currently very much fragmented with little or no standards even though it could deliver most value when it could be interlinked with wide variety of devices and services. As per the recent research by Capgemini, only 13% of the organizations offer IoT solutions that integrate with third-party products and services. Fragmentation is the enemy of the IoT as it hampers the interoperability between devices and creates the fear of being locked in amongst the customers. The main reasons behind fragmentation is plethora of devices and technologies available to realize the benefits of connected devices. This fragmentation prevents companies to deliver an ecosystem of product and services.

3. **Significant upfront investment:** Companies do need to invest a significant amount in acquiring new functional capabilities. Organizations need to restructure their product management, operations, account management, program management and sales process to provide proactive services needed for sustaining into IoT market.

3.4 Which Monetization model is best for you

There is no one size fits all monetization model in IoT as the companies vary hugely in terms of organization structure, needs and their core capabilities. Below are few suggestions as to which monetization model could work best for your organization.

1. **Hardware Premium:** This model is appropriate for those companies who core capability is hardware manufacturing and want to differentiate themselves from the competitors. By providing additional connectivity features and control to the customers, a company can charge a premium fee and increase their market share drastically.

2. **Service Model:** This model is suitable for products having high customer engagement and frequent servicing. Organizations which are good at providing services should look for getting continuous source of revenue through this model. Company could have a freemium model which allows customer to use some basic services which can be upgraded when paid a premium price.

3. **Data Revenue Model:** Companies which are good at collecting data from multiple sources and have capabilities to transform, analyze and drive insights out of it are appropriate for this model. Company can either sell the data or can package it with additional analytics to gain revenue. A critical challenge with this model revolves around data security and customer privacy. Organization should obtain prior consent before using the data and abide to local regulations.

4. **Ecosystem Building:** Companies that offer wide range of products that could be connected remotely or have superior technical capabilities in building up a platform should aim to build their ecosystem. These platforms should be open and must be compatible to other OEM's devices in addition to their own. Ecosystem like this will foster collaboration amongst the hardware as well as software industries. Moreover, they are the source of the valuable data collected through all channels, which can be further monetized. An open ecosystem also counters the fragmentation issue in IoT Industry, which is one the most prominent reason for the slower growth.

4. Industries mostly affected by IoT Marketing

The IoT is quickly expanding the amount of the data and information available to many industries and thus transforming many of them. Marketers now have opportunity to gain the insights of customer behavior and hidden patterns to embrace data driven decision making, helping them to get competitive advantage. Improved insight into customer behavior, enabling better targeted, higher quality products and services associated with customer loyalty, satisfaction, and value are few of the benefits marketers can reap. Below are the few industries which are transforming with the advent of sensor technologies and advanced analytics.

4.1 Automobile Industry

The automotive industry is going through a disruptive change due to advancement of IoT along with other technologies like Artificial Intelligence and Big Data Analytics. Car manufacturers and tech companies are looking at connected cars as the future which could offer many benefits, like improved safety and security, a personalized user experience, multiple connect touchpoints with customers and transformed vehicle ownership. According to a report by Gartner Inc., there'll be over 250 million connected cars on the road by 2020. Data which is shared by the car owners through their connected cars has a potential to revolutionize automobile marketing. Connected cars will be able to communicate with their owners as well as other cars which is an important factor in determining the value proposition and the supporting business model for connected car services. Connected cars will have impact on below dimensions with respect to marketing.

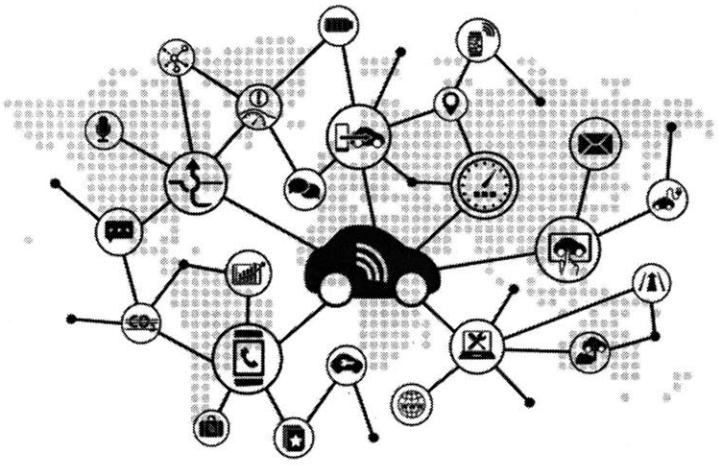

Figure 16 Future of Connected Vehicle (Register, 2016)

1. **Car buying:** Like mobile apps and software products, cars will allow the customer to add/drop the features upon purchase or pay for an upgrade later. Most of the features will be facilitated through mobile devices which will become control devices to operate connected car features. With IoT, it becomes easier for the customer to customize the cars as per their preference and prevent them for paying upfront for the additional features. The features or upgrades would act as a regular source of revenue for the car industry and moreover the marketers can get plethora of data about their customer preferences and driving habits using these features.

2. **Predictive car maintenance:** The concept of connected cars can be used to perform predictive car maintenance using advanced technologies like big data analytics and complex machine learning algorithms applied to data received via sensors. IoT would enable cars to share data like speed, location, status of various parts/lubricants of the car, and if the car needs urgent service or not. Marketers have opportunity to harness the data to offer car service, repair and maintenance. This enhanced customer service experience will increase the loyalty amongst customer and companies can exploit razor razorblade strategy to get continuous source of revenue.

3. **Dynamic Insurance Premiums**: With the help of data derived through sensors, insurance companies can now determine the rates of insurance based on the customer driving data. Companies will also likely to give discounts to customers who share quality data. Companies install a telematics device in Car which monitors the driving and look for patterns and insights from the network of drivers. IoT has given ways to model like pay as you drive (PAYD) where insurance is directly related to mileage driven and pay how you drive (PHYD) which charges you on basis of your driving behavior.

4. **Targeted Marketing**: Connected cars will help marketers to do more personalized marketing with the help of data collected through several sensors inside cars. With the help of interface which would be used by customers to interact with cars, marketers can gain insights like buying behavior and spending potential based on a consumer's driving patterns. Prediction could also be made about the nature of the trip depending on time, driving

behavior and route followed i.e. whether it is a trip to work, a typical trip to the grocery store or mall, a trip to an event, or a vacation. Tying up of purchase history with the trip will help marketers to send meaningful and relevant messages.

4.2 Retail Industry

IoT has lot to offer to the retail industry as it provides opportunities to increase supply chain efficiencies, develop new services, and redefine the customer experience. Large retail organizations like Amazon.com, eBay, Flipkart etc. sell thousands of products and serve millions of customers over a wide geography. These companies rely on significant marketing and sales efforts, complex supply chain operations, and sophisticated store-front infrastructure. Each of these critical business areas can be revolutionized with the availability of real-time sensor data. Advanced analytics, in-store sensor data, fleet data, inventory data can be aggregated with external data like customer demographics, weather, and fuel prices to improve the effectiveness of distribution channel investments, minimize supply chain costs, and optimize store operations and capital expenditure. Below are the few areas being explored using IoT.

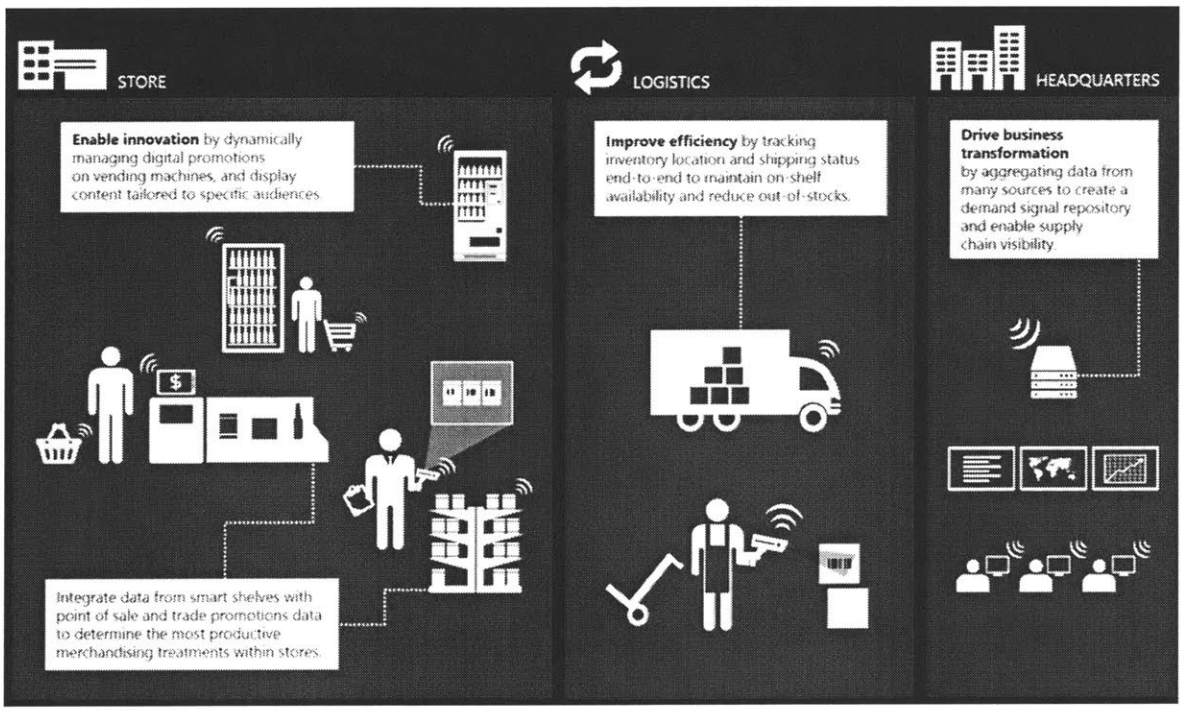

Figure 17 IoT Landscape in Retail Industry (Shishirs, 2015)

1. **Responsive Retail:** In the early days of the retail industry, the department stores, grocery stores and shoes stores has personalized experience but it was pretty much inefficient. Now retail industry has become bigger and faster but personalization on the other hand has fell off. IoT has capability to bring effectiveness and personalization to the retail industry through sensor data and edge analytics. Retail stores can now analyze the market trends quickly so that they get the right product at the right place at the right time. Responsive retail is all about tailoring to the customer's desires. Advanced technologies like in-store sensors, inventory analytics, and advanced point-of-sale solutions can be unified to provide responsive retail. A store could have personalized digital signage that changes advertisements to match the profile of the person directly in front of it. Using sensors, the stores can find the patterns in foot traffic and can place their items intelligently and analyze the performance of a product on the real-time basis.

2. **Inventory Management:** Inventory can be checked in stores and warehouses using sensors and 100 percent inventory accuracy is possible to make effective use of space. Stores could use real-time data and predictive analytics to keep themselves stocked and anticipate potential problems. Stores could also connect with the social media to figure out a recent endorsement by a celebrity and can handle mad rush on limited stock. With the right technology, stores can handle issues before they become revenue-losing crises.

3. **Targeted Marketing:** IoT is helping marketers to send personalized messages to the customers through various devices like digital signage, kiosks, and vending machines. Digital signage would be able to show targeted screens based on the users past purchase history and their foot traffic and behavior. It will also allow users to post the content and connect to social feeds. Vending machines have been evolved too and they are engaging shoppers like never before with touch-screen controls, video, audio, scent, gesture-based interaction, and cashless payment. Like vending machines, kiosks too have potential to become far more interactive with high-definition video and audio and provide dynamic advertising.

4. **Cashier less Retail Store:** Amazon started beta testing of no-checkout retail store called 'Amazon Go' in Seattle. The philosophy of the store is to grab an item and just go without

standing in line to pay for your items. 'Amazon Go' has revolutionized the way we shop items from a grocery store. With the help of IoT sensors with machine vision capabilities, advanced analytics and machine learning, the store let the shopper pick up the item from shelf and leave the store without worrying about standing in a checkout line to make a payment. The charges are automatically deducted from the Amazon account depending on items purchased. As an Intern at Amazon this summer, I had an opportunity to visit and shop from the store. The store looked very similar from inside with no trace of sophisticated

Figure 18 Amazon Go Store-View from inside (Leswing, 2017)

cameras and wires around the shelf yet it charged my account perfectly. In future, we can expect similar stores leveraging the capabilities of machine vision and IoT.

4.2.1 Blue Sky Idea: Preventing Inventory Loss during transit

While working as a Senior Program Manager at Amazon Inc. as summer intern, I realized that significant proportion of the inventory gets lost during the transit between different parts of the supply chain which is hard to control and track. Although some countermeasures could be applied such as security cameras, locks, GPS, employee training etc. but still cargo theft crimes have risen over 150 percent and still increasing. Apart from the theft, there could be possibly other reasons behind the loss of inventory such as carelessness while shifting the merchandise or during the last mile delivery to the client. In the US, cargo theft is estimated to be between $12

billion and $15 billion annually and it corresponds to nearly 3.5% of the total e-commerce retail sales of $409B in year 2017 ("U.S. e-commerce market size 2015-2022," n.d.). Usually the high-priced items are the target of such malign plans hence even smaller number of items lost result in huge loss. These losses caused by either theft or mishandling result in the lost revenue, bad customer experience as well as negative brand image and PR. Currently, employing the GPS in the truck help prevent the cargo theft in the case when thieves get hold of the whole truck but still in many of the scenarios, the thieves quickly get rid of the original truck to evade the GPS tracking installed on it. Inventory loss caused by theft or the carelessness can be handled by putting on GPS chips on each of the merchandise costing above a certain threshold to offset the cost of tracking and maintaining the device. Though this solution has not been implemented by any of the companies currently but with increase in the inventory loss and decrease in the cost of the sensors along with increase in the data analytics proficiency, one can track the package till it reaches the customer.

Miniature GPS devices that can fit inside a 100-count pill bottle are available in the market costing anywhere between $10 to $15. The exact location of the packages containing these GPS chips can be tracked easily on computers, mobile phone and alerts can be configured if any of the package is opened before reaching its final destination or if there is deviation from designated route. Putting up a GPS tracking sensor on high cost items will help companies save significant revenue and at the same time will add to the value proposition by providing the ability to customer to track his/her package on real time. This will help customers to be better prepared to receive the package along with the assurance that package has not been tampered with after leaving the warehouse. Online E-commerce retail giants must conduct a cost benefit analysis considering their profit margins, cost of the GPS chip, operational cost concerned with tracking the device, distribution of the items being sold as well as items being lost.

Example below demonstrates cost benefit analysis to figure out the least cost of item over which it would be profitable for companies to apply a GPS tracking chip on the package. (All the figures below are hypothetical and must be replaced with exact figures)

Least cost of the item over which GPS will be applied = X
Cost of the GPS Sensor: $15
Operating cost of GPS device: $3

Number of online orders in US assuming $100 is the average cost of order ($409 B/$100) = 4B

Cost of putting up GPS device on a single item = $18 --- 1

3% of inventory loss items = .03*X --- 2

Equating equation 1 and 2, we get X= $600

Hence, it is viable for the company to apply GPS tracking device on items above $600 to offset the loss incurred due to cargo theft. We can see that as the price of GPS chip gets reduced, we can track even low-cost items.

4.3 Smart Home Industry

IoT will make almost all physical objects connected to the Internet and enable machine to machine communication. This will include everything from coffee makers, washing machines, headphones, lamps, wearable devices and just about anything you could think of. Smart Home devices can help reduce costs and conserve energy where smart thermostats will automatically turn off when you're not home, which would lower your electric bill and reduce energy consumption. Smart lights would function in a similar way. The opportunities are endless. Fig. 19 shows one of the impact of the IoT Smart Home in our lives.

Many companies are offering a smart home platform which acts as a brain of all the connected appliances in homes and enables communication between them. With these solutions, one can control all of the home devices including lights, thermostat etc. and can even schedule the tasks to automate the entire home. Apart from providing comfort, safety and convenience to customers, smart home offers a tremendous opportunity for marketers to understand their customers and reach out to them to offer a product even before they realize that they are in need.

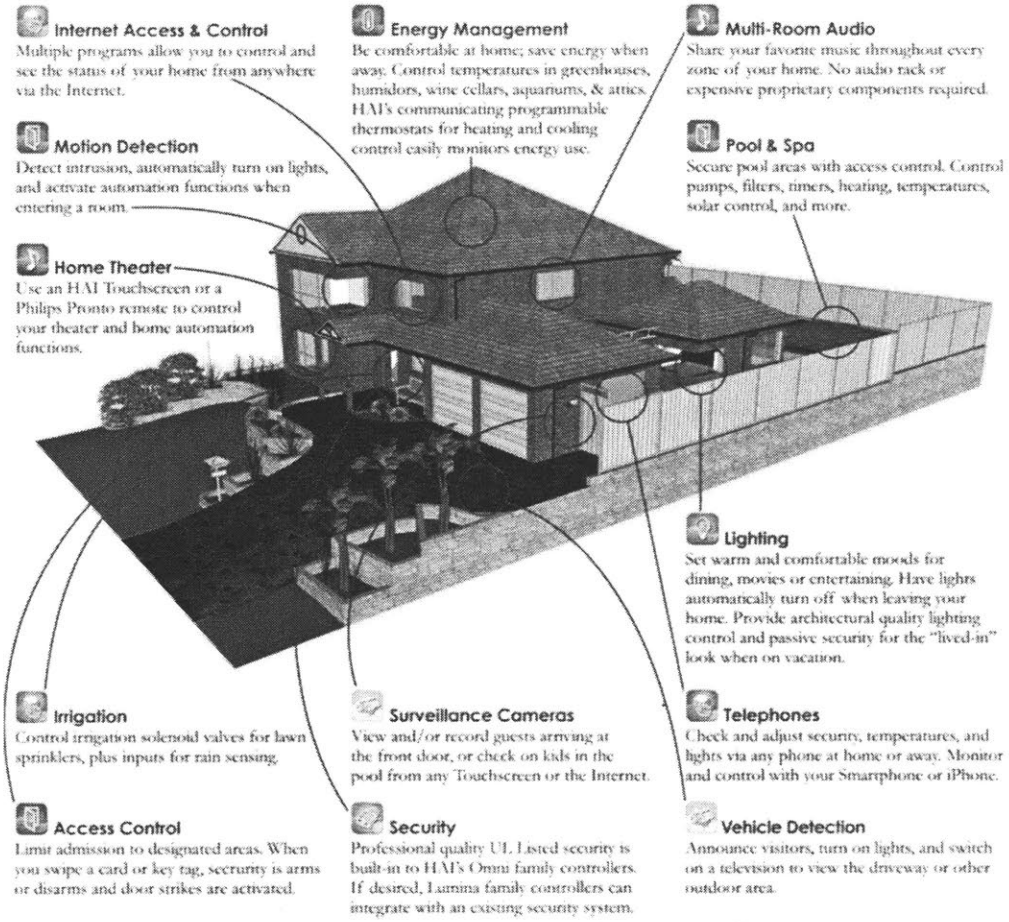

Figure 19 Smart Home Industry (Churchill, 2014)

Below are few ways in which smart homes will revolutionize marketing

1. **More access to personal data:** Marketers have great opportunity to connect with customers via different IoT devices and they will be able to gain more real-time data about customer's activity and state of mind. For example, a customer watching smart TV would be more relaxed and open to content from advertisers as compared to when he has just arrived from work and goes into kitchen to prepare a meal. Using predictive analytics and past consumer behavior, marketers can advertise their product appropriately to increase the conversion rate. However, these marketing solutions come with a caveat of breaching the privacy of the customer which will make the experience worst and can ruin the relation.

2. **Predictive Maintenance:** Predictive maintenance of smart home devices is applicable in the same way as it is for automotive industry. Sensors in the devices would determine if the

device needs service or maintenance and will contact the manufacturer before the problem occurs. Thus, IoT will reduce the down time of the device by contacting the technical support whenever needed. Upgrades will also become easy and will not depend on manual intervention which leaves the devices open to security compromises or known problematic issues especially if the upgrade is related to security tightening. This would result in higher customer satisfaction and will increase the brand loyalty. Predictive maintenance would help companies in retaining their customers by proactively acting whenever customer is in need. Hence IoT will help companies gain a significant RoI on their product and companies can utilize full potential of Razor-Razorblade strategy.

3. **Self-Promotion:** IoT devices will be capable enough to promote themselves by connecting with the social media. Thus, the outreach of the devices and services would enhance tremendously which is not been possible if devices operate in silos. Marketers will be able to reach more potential customers which they might not have been able to reach previously. The IoT devices can generate automated posts and shares themselves, and help create online close-knit communities having like-minded people, increasing the brand loyalty among the customers. Currently, marketers do create a buzz about the product during the pre-launch and launch phase with the help of PR and digital influencers. IoT devices would rather speak for themselves once users start using its services. Promotion of this kind would prove to be more influential than the former one in making an impact on purchase decision of customer.

4.4 Manufacturing Industry

The manufacturing industry is the vertical where most of the Industrial IoT investments are made. Manufacturing covers many types of product, operations, components, machines, people and data. It is way to transform raw material to the finished good through supply chain, logistics and transportation. Currently most of the components of manufacturing industry are not inter connected and there is a huge potential to gain operational efficiency and customer engagement in this process. The figure below represents contexts where IoT is leveraged in the manufacturing space. There are numerous opportunities for a marketer in the manufacturing space. Few of them are mentioned below:

1. **Customer Preference:** IoT enables optimization, digitization, and transparency from end to end in the manufacturing environment along with enhanced services towards customers. The insights gained from an integrated manufacturing process from the customer side are crucial and used to offer better products, quality and services. With IoT, the manufacturing process can be well connected with the supply chain, operations and transportation which would enable the real-time insights from customers used to tailor the manufacturing process. The quality of the product could be enhanced depending upon the sentiments of customer. IoT would enable manufacturers to implement the pull rather than a push strategy which is a key element to the lean toolkit. This strategy would help manufacturers reduce the excess of inventory while meeting the quality expectation of the client.

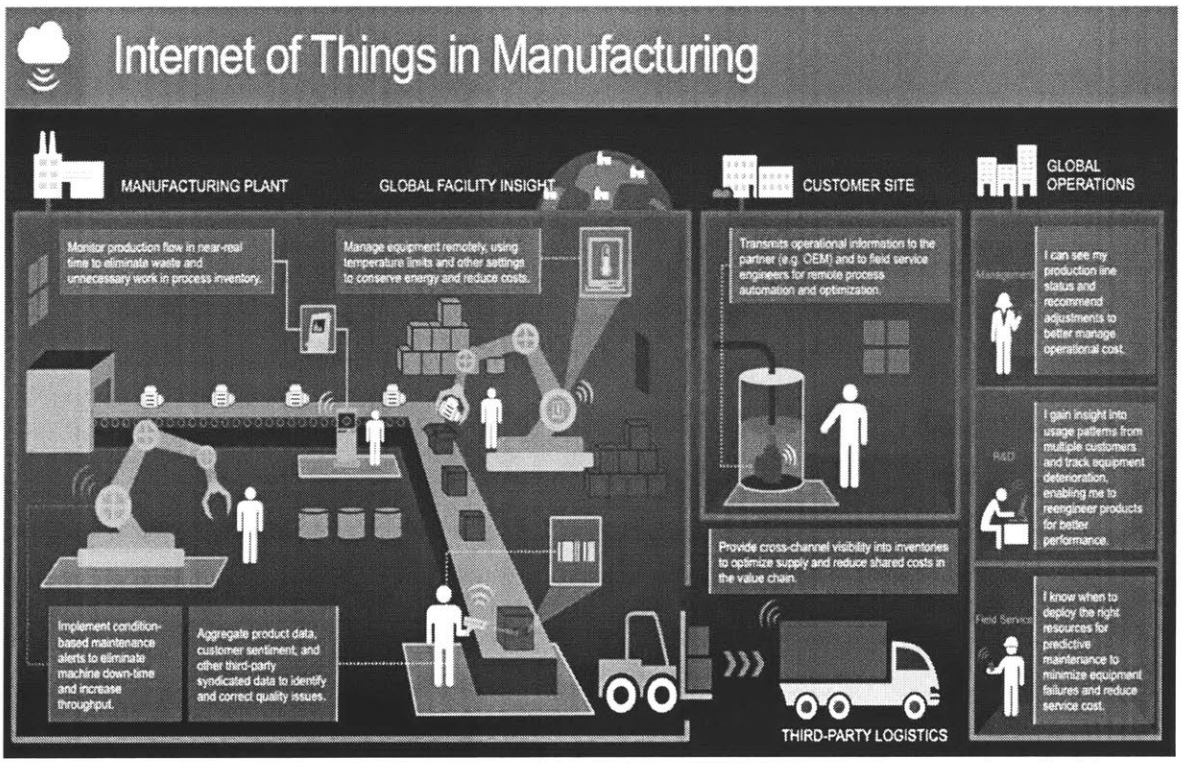

Figure 20 ("Internet of Things in manufacturing - the Microsoft view - source SlideShare presentation large," n.d.)

2. **Digital transformation:** IoT is one of the key technological advancements that is helping manufacturing process to become digital which revolve around the capacities to be more agile, people-oriented, innovative, customer-centric, streamlined, and efficient. End-to-end customer experience optimization, operational flexibility and innovation, are key drivers of digital transformation, along with the development of new revenue sources and information-

powered ecosystems of value, leading to business model transformations. In addition to having focus on traditional assets, digitization focuses on less 'tangible' assets such as information and customers Both customers and information need to be treated as real assets in all perspectives.

4.5 Healthcare Industry

Healthcare Industry is going to get disrupted by the growth in IoT in the years to come. IoT use in healthcare is very broad. It ranges from sharing the patient's real time medical condition with their caregivers, monitoring and troubleshooting the equipment to ensure safety, real time location tracking of medical equipment, and even improving how physicians deliver care. It will help physicians turn IoT data into actions. The IoT has the potential to make a massive impact in workflow optimization and other aspects of healthcare. Below are few salient features of IoT which would help marketers in the field of medical industry.

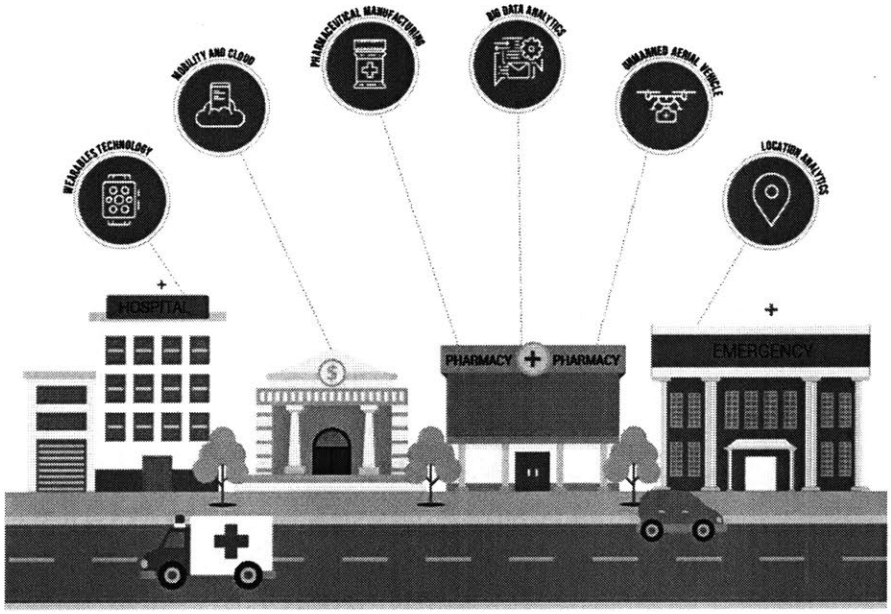

Figure 21 IoT in HealthCare Industry (Dhande, 2016)

1. **Patient satisfaction:** Real time updates about the patient's health help boost patient satisfaction and thus increases the engagement. At Florida Hospital Celebration Health, families of patients being operated on don't have to depend on a doctor or nurse to let them know when their loved one is out of surgery. Patients expect more interaction with the

doctors and IoT sensors and analytics can track that time precisely and will improve patient experience. Connecting pacemakers and other medical devices to the internet benefits patients by reducing errors and providing more data to doctors to improve diagnosis and quality of care.

2. **Increase efficiency:** The IoT will enable data collection that would normally be taken at doctor's office, which doctors can use to get complete view of patient's health. This will offload some mundane tasks that occur in healthcare and will free up the resources that are already over-utilized. The doctors can spend the saved valuable time in engaging with patients and interacting with them more.

3. **Personalized treatment through wearables:** Currently physicians rely on their electronic health records (EHR) to store and manage patient data. Despite having data such as lab results and medical history stored in those systems, there are other aspects of patient interactions and health data outside of the hospital that are not being collected by those EHR platforms. According to a recent survey conducted by A&D medical, 56% of Americans want to track their health via connected devices. At the end of 2014, the global market for wearable medical devices accounted for $2.8 billion in revenue. Data captured from wearables, electronic communications and a patient's personal preferences will open new realms to improve patient engagement. Wearables can be used to track blood pressure, heart rate, number of steps taken, sleep cycles, and other health related indicators which will help marketers to promote and advertise the relevant product to increase the conversions. With help of wearables, health care providers can monitor the patient's 24x7 activities and can offer an appropriate medication and advertisement to enhance customer relationship. This will disrupt the business models of few OEM's as they will partner with the healthcare providers and pharmaceutical companies to promote their services when the patient is in need of them. IoT can also help pharmaceutical companies get a great new way to track the results of clinical trials. Currently there are few wearables available in market like Fitbit, jawbone, apple watch and goggle glass but their full potential is yet to be realized.

4. **Glance-able marketing:** Marketers have opportunity to deliver the relevant advertisement

on the wearable devices. Since the marketing space will reduce drastically even when compared with advertising on mobile device, messages need to be short, simple and sharply focused. This trend of advertisement is called glance-able marketing which focuses on producing a content that could be comprehended in less than 2 seconds. With wearables, location based marketing would also eventually proliferate which would help marketers to promote contextually.

5. **Virtual health assistant:** The future of health care industry is Virtual health assistant which would work similar to how Amazon Echo, google home and Cortana works but with far more functionalities. Patients can use them to receive medication alerts and appointment reminders and take routine health assessments and surveys. These devices can also act as patient education tools to improve customer engagement.

4.6 Smart Cities

As per the Wikipedia definition ("Smart city," 2017), a smart city is an urban development vision to integrate information and communication technology (ICT) and Internet of things (IoT) technology in a secure fashion to manage a city's assets. These assets include local departments' information systems, schools, libraries, transportation systems, hospitals, power plants, water supply networks, waste management, law enforcement, and other community services. The aim of the smart cities would be to reduce the cost and resource consumption and to improve communication between citizens and government. Few cities of the world have already been transformed and continue to embrace this concept to improve sustainability, livability and quality of life of their citizens. Few examples around the world are Barcelona, Copenhagen, Singapore, London, Seoul, Helsinki and many more. Below infographic presents different aspect of a smart cities.

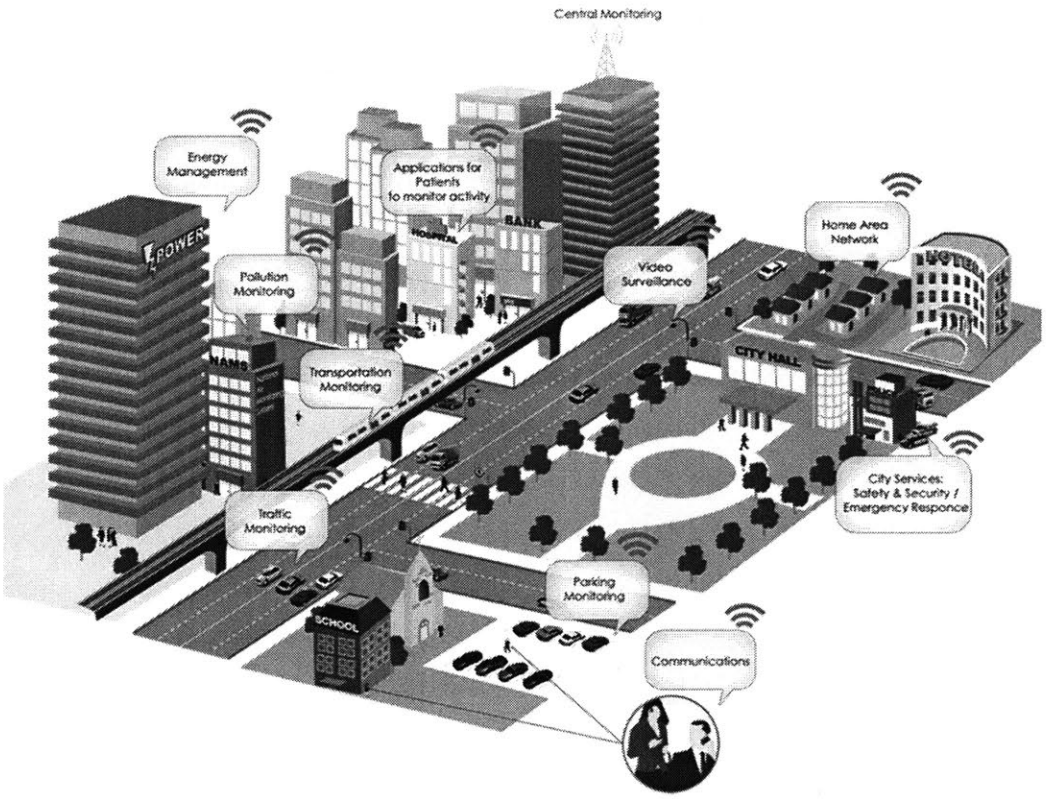

Figure 22 Concept of Smart City ("Smart Cities |," n.d.)

Smart cities have lot to offer to a marketer as it presents the immense lakes of data that could be used for the marketing purpose.

1. **Ubiquitous Marketing:** Smart Cities will provide data of every potential customer which would reveal the routine, preferences, shopping habits and general behavior of that person. This data when merged with existing data sets, such as social media profiles or online purchases, the result is a veritable gold-mine of information. With devices covering a city, conceivably, messages could be delivered to customers pretty much anywhere, at any time and via any medium that has a display. For example, data could reveal that a person lingers outside the clothes shop did not make a purchase. The same person could be identified using the app and later on ads for the same or the similar products could be later on targeted on their laptop at a time when they are known to make majority of purchase. On the similar lines, retailers such as John Lewis are already making tentative steps in this field by installing

beacons that can identify shoppers via an app. Using this information, staff in John Lewis receive notifications that tell them that a shopper who bought an item online has arrived to pick it up. A smart city would enable this and many other innovations on a grand scale. In order to develop an effective campaign, the marketer should design it considering Market, Message, Media and Mode. Market determine the target customer segment who you want to communicate to, Message corresponds to what to tell, Media corresponds to channel used to communicate the message, and Mode refers to time when the campaign needs to be send.

2. **Marketing on the fly:** As the whole city would be covered with sensors and a layer of Wi-Fi connectivity in the smart city, marketers can perform real time analytics to serve the campaigns on the fly. One possible use case could be to analyze the traffic situation and the car's segment, owner's behavior to determine the advertisements on the billboard. Issues with the existing billboard industry is that it is static, irrelevant and hard to recall. With IoT solutions, the content of the billboard would be dynamic, relevant and easy to recall with smart cities solution. A smart billboard will change the content of the advertisement dynamically on the run time based on timings, traffic conditions and type of cars passing by. A typical use case could be showing an ad of the exotic vacation to the person sitting in luxury car. An app would later on help him to get the necessary details in case he wishes to pursue with it.

However, access and ownership of data is still an issue. It is speculated that municipal authorities or private parties that install devices will seek to recoup the cost by selling access to the data the devices collect. Also, privacy is one of the major concerns which can cause people to alienate quickly if they perceive that their personal information is getting misused. There must be some strict policies a brand must undertake to limit the messages each person receives.

5. IoT Product development strategies

Traditional product development strategies involving year-long development cycles, stage gate processes, and isolated requirement gathering will no longer be valid if companies need to develop an IoT Product. Since software is one of the key components of the IoT product hence some big changes need to be implemented in product development process. IoT products will be sum of three components: physical, software and connectivity and hence will be more dynamic in nature as compared to traditional static products. Below are few strategies to follow throughout a product development lifecycle.

1. **Identify the customer:** Segmenting the market and targeting a specific user persona is the key step toward a successful development. Apart from user, marketer must also understand if the customer is different from user and must take into account both of their interest while finalizing product features. A customer is the one paying for the product while a user is one who uses it. Calculate the total addressable market and design the product based on customer needs and pain points which aligns with the strategic direction of the company. Brainstorm on all the possible features and prioritize them based on the consumer research as well as competitive analysis.

2. **Continuous product improvement:** Companies should focus on continuous improvement through innovative, open, collaborative, and customer focused culture. Instead of following a waterfall model for product development, IoT products needs to follow agile and dev-ops approach wherein different teams within the company aligns itself towards refinement of the product. High quality product must be ensured from the very beginning of the cycle. Development in short sprints must be taken out with planned iterations in case of detection of quality degradation. The product could be improved even after having release it to customers by analyzing the sensors and software attached to physical products. The data collected helps product development team to understand popularity of features, unique use cases and customer perspective towards the product. IoT products can then be enhanced using

3. **Focus on customer feedback:** IoT products are very much customer centric and must possess intelligent design which is elegant, easy to use and understand, useful and innovative. To deliver a high-quality product which deliver these experiences, all the teams within

organization from engineers to product manager, designer to product marketer must understand the dire need to the customer and product experience. Feedback from customer plays a very important role in determining the product roadmap and shortlisting the features. Marketers must keep in mind the perspective of customer before initiating a product and must communicate the same to all the verticals within organization. There are various methods to capture voice of customer such as Primary Market Research (PMR), surveys, focus groups, questionnaire etc. Voice of Customer (VoC) can help refine the product to reduce the friction in the customer experience. The product team must work very closely with the customer to validate and build out the ideas.

4. **Open Ecosystem:** IoT product should not be created in silos as we have discovered that IoT yields maximum benefit if it is operated in an ecosystem. IoT product heavily relies on network of partners in development, implementation, and commercialization phases. The wide range of hardware, software, connectivity and data analytics skills require a company to partner with other companies. The company should utilize their core competency to the maximum but at the same time partner with the companies which offers relevant skill set needed for development. APIs provide innovate way to exchange the data between the partners but it must be used cautiously as it is usually give and take affairs wherein partners expect data in return for the API integration. The experience the device delivers to customers will be based on its ability to integrate with other IoT devices, data sources, and hub ecosystems. Companies must foster better skill and data sharing amongst themselves to deliver maximum benefit to the customers. For example, currently the successful smart home products such as Amazon alexa, Google home, Samsung smartthings etc. do provide their API's to community of developers to foster open innovation and offerings.

5. **Cross functional collaboration within organization:** The skill of requirement gathering of customer needs is different from developing a product hence there must be a high level of collaboration and mutual understanding between the different verticals of the company. All the three domains i.e engineering, design, and marketing must move hand-in-hand to deliver a successful product that meets all the stakeholder's needs. One of the biggest obstacle a company faces is lack of required skill sets needed to develop an IoT product. The team who

works on requirement gathering must be able to use design thinking approach along with system thinking to develop an IoT product. Realignment of the teams is necessary to enable better communication and collaboration which can be achieved by focusing on small, cross-functional teams tightly knit under the supervision of the product executive.

4. **Transition to agile development and prototyping:** Agile framework requires the frequent release of the product within the duration of the sprint to get the customer feedback immediately. Agile methodology requires a team to create the product roadmap and backlog to ensure prioritization of features. Prototyping is another useful tool to realize the product beforehand to ensure proper alignment within the company and the customer's interest. During the initial phases, low-fidelity prototypes or white boarding act as proof-of-concepts. Another important feature of agile methodology is that it minimizes the rework by limiting the development cycle. Any deviation from the plan or any defect in the prototype can be rolled back to the last successful stage. This reduces the time to market which is a crucial aspect in today's cut throat competition. Since an IoT product involves both hardware and software component, hence one should carefully break the development into smaller chunks. Software teams can follow the short sprint cycle while hardware development will still follow some level of waterfall methodology because the requirements needs to be define upfront but still within the phase one can work iteratively.

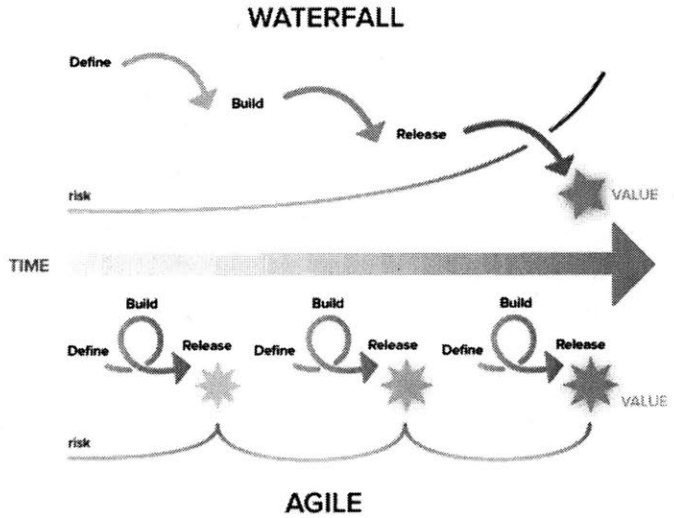

Figure 23 Comparison of Agile with Waterfall ("Thit | Project Management," n.d.)

5. **Develop new skill sets and invest in training:** Developing IoT product needs new level of technical, business and communication skill set. The companies should hire the required talent if the skill is very niche and train the existing employees who are responsible for product development as well as management. The IoT industry is moving at a very fast pace and to keep up with the new practices and technologies, one must be curious as well as have natural inclination towards learning. Few skill sets are a must for an IoT industry and data science skill is one of them which requires understanding of data and converting it into meaningful insights. Data driven insights are very helpful as hit reduces the risk of failures and help company understand the underlying behavior of the customer.

6. IoT Product launch strategies

Companies need a winning launch plan to gain traction from the customers as well as prospective partners like developers, firms and investors. A successful launch starts with developing a great product which needs lot of research regarding the customer's need and identifying the underlying opportunity, communicating and messaging the value proposition in the market, integrating the channels, and executing the marketing strategies and tactics as per the plan. In a crowded and competitive market, it is critical for the marketers to position themselves to become leader and to remain relevant in the ever-changing business landscape. Before jumping on the launch strategies, we will first look at the basics of any marketing plan which lays the foundation of any launch strategies.

6.1 The Basics

Below are the few basics that a marketer must keep in mind before and during the product launch. Steps below could also be considered under Pre-Launch activities.

1. **Define the product features:** It is important to understand the distinct features of the product to define the value proposition it offers when compared with the competition. Product features also help in defining the market segment a marketer needs to target. The product must be created specifically to solve customer problems and needs and marketer

must completely understand that how it is different from the other similar offerings.

2. **Launch goals:** Identify the goals of the launch. Does the company want as many users as possible with an intent to increase the market share, want to ensure profitability upfront or want to ensure a positive reaction by doing a beta launch and then refining the product based on the customer feedback? Launch goals must align with the corporate strategy and mission of the company.

3. **Launch design:** Once the launch goals are finalized, marketer must determine how to achieve them. There are several launch strategies related to introducing the product in the market. One can go with the full-scale launch to get as many users, or can roll out a limited version of the product through soft launch in a test market or launch a beta version by either allowing only employees or allowing users through invitation system to refine the whole product.

4. **Diversify the channels:** Once the product features are defined and target market segment are finalized, marketer must look for the appropriate channel to publicize the product to the customer. In order to compete with the plethora of products already available in market, a marketer must touch every communication component that falls under the marketing umbrella. Marketers should take an integrated approach to combine PR, content marketing, social marketing, digital marketing and other traditional approaches.

5. **Building a customer persona:** Creating a killer product loaded with great features isn't enough to ensure its success. Understanding the end users and targeting them by building a customer persona helps marketers focus on marketing approaches. Few questions to be asked regarding who is most likely to use your product? Be very specific in choosing a segment and consider factors like age, buying power, geography, occupation, education, marital status, gender etc. Lifestyle, buying habits and needs of millennials are very different from non-millennial and hence they must be approached using different strategy.

6. **Calculate TAM:** Calculating Total Addressable Market is important to measure if the

market is worth investing. It also gives business partners and stakeholders a clear idea about what to expect. TAM is the amount of revenue earned annually considering that 100% of the market share is achieved. TAM will be an important metric to determine the success of the product post launch where actual market share and growth will be calculated.

7. **Test your assumptions about the market:** Since assumptions are not the facts, hence a marketer must do an in-depth research about the viability of the product and must collect data through surveys, questionnaire, focus groups, interviews etc. to access the market need and to show that the product is addressing those needs. It is also wise to look at the competitor's offering and to analyze what worked and what not for that to increase the learning curve about market. It is also worth researching whether your IoT product is unique or not as chances are much that somewhere there is an offering similar if not same available in market.

8. **Acquire the customer before getting customers:** In order to validate the offering, it is always a good idea to present your beta version of the product and make it available for use to the customer which could be treatment group, set of people who represents target segment or even an existing employee to get their views of the product. It is very important to understand the behavior of your customer in terms of how they perceive your product and use it and whether they find it useful, easy to use and understand. Try to get the feedback and genuine opinion about the product to make suitable changes during the development cycle only. Use the feedback to figure out what they liked, what they think, what they don't want and whether the product is really meeting their needs. View your customers as collaborators and take their help in refining the product features and roadmap to reduce friction in the customer experience.

9. **Don't just build all the features:** Don't spend years building the complete product rather build the Minimum Viable Product (MVP) and release it in market. The MVP should have minimum features which delivers the core functionality and for which the client is interested to readily pay. The rest of the software features must be delivered as a further release to the original version. There are mainly two reasons behind this strategy - Firstly, it reduces the time to market and gives an edge to capture the market as early mover. Secondly, it allows

the marketer to analyze the customer's behavior and success of the product which plays an important role in shaping the future roadmap of the product.

6.2 Launching an IoT Product

IoT is still in its in-fancy stage and there is lot of hype about the new and connected technologies. This often creates misconception of fantastic opportunity available in market but a careful evaluation is needed from marketer to understand value proposition and the business model of the product. Make sure that you fit in the appropriate tech market and position yourself as experts of the field. Communicate your strategic goals and future plans to key media and analyst influencers in the space. Present a different perspective to customer about the use of the IoT and narrate a story around that which touches the lives of your customer and make them feel connected to your offering. Take mindful steps and challenge the status quo to revolutionize the market. Below are the few steps to be taken specifically for launching an IoT product.

1. **Educate your target market in their language:** If your customer doesn't know or knows little about IoT, then it would be difficult to convince them about your offering. Marketer should spend time on the content strategies to educate their customers. Try to speak in their language and not in technical jargon about what the product could solve for them. Don't emphasize much on technology behind the product and some jargons or buzzwords which your customer doesn't understand. Rather stay focused on the value proposition in the laymen language.

2. **Focus on your strongest value proposition:** The IoT product being launched might be solving a lot of problems out of which few could be the most obvious ones while others are the ones which are unconventional but yet the pain points of the customer. Try to focus the content of marketing to emphasize the dire need of the customer. For example, BarVision, an IoT device for the bar owners uses wireless smart spouts and easy to read dashboards to monitor the inventory. It helps bar owners keep track of the amount of alcohol sold and poured or spillages and whether the bar tender was making a wrong recipe and thus finds out area of opportunity to increase the number of pours per bottle and hence the revenue. The product didn't take off well for initial few years until they realize that the main issue a bar owner faces is not inventory but rather training issues. When they changed their marketing

emphasis from BarVision being an alcohol monitoring and tracking application, to marketing BarVision as a tool to engage with, train employees, and discover new sales opportunities, their sales "took off." The product didn't change much but the marketing strategy changed to make big sales.

3. **Timing your launch:** If the IoT product is ready to release in the market, it is worthwhile to consider the timing of launch around industry event or advancement. It is also important to make sure that your launch doesn't get unnoticed amidst big announcements made by other major players. Another important consideration should be market trend which consists of rules and regulations, customer preference change, economic conditions etc.

4. **Use proven case studies:** There is a lot of hype going around the IoT and because of the industry fragmentation, the customers are bit suspicious about the solutions which is offered. Show your customers the examples and deployment case studies which help them correlate with the problem at hand and increase their trust. Show the industry what you have by backing it up with real life use cases and examples where current customers have benefitted. Customers only buy trustworthy product which are proven. If a product is completely new in the market then have a beta version available for customers to try and get their testimony in return. The more RoI you can demonstrate, the more credible your message.

5. **Gain knowledge about industry:** Knowing the industry, its trends and current advancements is as important as knowing the product. It's worth spending time in researching about the influencers to keep in touch with them and reach to them in promoting your product. Marketers should also spend time in researching about the market trend, current prospects and conversations currently going on social media like LinkedIn, Twitter, Facebook and other developer portals. Tracking news, hot topics and competitors offering will give marketers a basic understanding of the IoT landscape and will help them to relate better with the customers as they would know all the possible solutions available in market along with their differentiating factor. Marketer's would also know what are they lacking and where to position themselves and work strategically on which other aspects.

6. **Establish your presence:** It is important for a marketer to establish the brand's presence in the right IoT events happening across the globe. IoT focused seminars, shows, forums and conferences are growing in popularity but one cannot be present and afford to be in every event hence choose your events wisely. Marketers should research and try to answer few traditional questions like: Who are the event organizers? Is the core audience going to be available? Is the event well known and have farther outreach or very new? These events help companies to gain business and traction from media. Another advantage of these conferences could be that one could find opportunities in unexpected industries. Apart from joining the conferences, it is also beneficial to organize the coffee chats, hosting a breakfast event, setting up in-booth demos and scheduling one-to-one sessions with the influencers, press and decision-making units (DMU) of the businesses to promote your product.

7. **Insist on visuals than words:** IoT is complex to understand especially for those customers who are from non-technical background. Marketers should develop visuals showing step by step concepts that customers can easily understand. Try to showcase the benefits and how they can solve the problems so that customers can relate to it. Along with the visuals, release few videos of not more than 3 minutes explaining the problem customer is facing and how you could benefit them through your value proposition. Several companies like IBM, Intel, C3IoT etc. have small videos on their websites which explains their concept. Along with the visuals, photos, infographics and videos, slide deck that explains the IoT solution speaks for itself. There are few platforms like YouTube, SlideShare which could be used to promote the material and has huge number of audience and a good outreach. To get immediate views of your visual content, you may want to pay for placement. Distribution services like Outbrain or Taboola can help you reach and serve up content to your defined target audience.

6.3 Post Launch activities

There are number of activities which needs to be performed after a successful launch of the product to ensure that it is going on the right track and meeting the expectation of the client. Below are the steps needed to perform to get the insights from launch.

1. **Customer feedback**: Get the feedback from the users to validate the hypothesis about the product and customer behavior. Figure out the existing usage pattern i.e. which of the

features are mostly used by the customers and where further investigations are justified or which features are least used which needs modification. There are numerous ways of collecting the feedback – gathering customer sentiments through Social Media, conducting surveys and focus groups.

2. **Effectiveness of go-to-market strategy:** A well designed launch strategy increases the conversion rate as well as the revenue. To ensure a positive cash flow and convince the business partners about the future prospects of the product, it is important to measure few metrics.
    a. **Cost of customer acquisition:** It is the cost to acquire a customer which can be calculated by simply dividing the expenses incurred in marketing including operational cost and implementation cost by the number of the customers acquired in during that expense period. For example, if the company spend $100 on marketing in a year and acquired 50 customers then Cost of customer acquisition is $100/50 = $2 per customer.
    b. **Conversion Rate:** It is the percentage of actual customers acquired out of the desired targeted segment. For example, if 100 people were targeted for the product out of which 20 end up buying it then Conversion Rate will be 20%.
    c. **Lifetime Value of the Customer (LTV):** It is the projected revenue a customer will generate during his/her lifetime. LTV of the customer must be higher than the cost of acquisition to sustain the business. For example, if a person is a loyal customer of a mobile phone XYZ and is expected to use the phone worth $500 for next 12 years with the replacement cycle of every 3 years. Assuming if the profit margin of the company to be 20% and cost of acquisition to be $50 then LTV would be (12/3)*$500*0.2-$50 which is $350.

7. Interview Insights

In order to understand the current landscape of IoT industry, interviews were conducted with the leading product marketers and managers working in IoT Industry. The goal of the interview was to understand the challenges faced by executives at various stages of the product lifecycle and to figure out the best practices to be followed to ensure the success of IoT initiatives.

I am extremely grateful to the interviewers who took time out of their busy schedule to share their insights on current trends. Four out of twelve choose not to disclose their identity hence excluding them from list.

1. Jay Mason, Associate Partner | Analytics, IoT & Cybersecurity
2. Rahul Garg, Sr. Program Manager (Azure IoT R&D)
3. Erick Corona, Director Products C3 IoT
4. Akram Sheriff - IoT Solutions Architect, CISCO
5. Pamela Gupta, President & Senior Security Strategist
6. Dan Ledger, Founder / Principal at Path Collaborative
7. Horacio Ballinas, IoT Data Analytics Product Manager
8. Renil Paramel, Senior Partner

7.1 Challenges encountered during product lifecycle

Almost all the new technologies face some challenges during the early adoption stages and IoT is no exception to this rule. As the time passes by, we will see more investments in this area by the companies but as per the current situation, there are still many challenges which needs to be overcome. As the internet and mobile phone technologies have come a long way after getting refined numerous times, the IoT also needs to get refined before becoming an essential part of our lives. Interview with the leading executives in the space of IoT revealed a general trend of common challenges which are acting as a biggest barrier.

1. **Designing an apt product:** Finding a meaningful problem to focus on where a new offering will be impactful enough to get organizations or customers to abandon existing solutions. Selecting the right hardware components amongst the tens of thousands of microprocessors and the right software stack amongst lots of competing protocols out there and finding the

right partners to work with and aligning business models is one of the biggest hurdle in IoT Product development.

2. **Market fragmentation:** There are too many layers and technologies in end-to-end IoT solution. The maturity of various IoT architecture layers is still not clear. With the rise in the investment, there has been an influx of companies coming up with their own technologies which has made it difficult to create a stable ecosystem and to create a product which is interoperable with other products. To the end customer, it is both costly and time-consuming activity to use different IoT devices together. Marketer must convince the user for an economical and scalable end-to-end solution in order to gain market share. In the near future, we can expect to see standards and open source platforms to encourage collaboration between different IoT players.

3. **Digitizing value streams:** Industries are bringing the digitization i.e. introducing technologies like IoT, Big Data, Cloud and Mobility. However, the success and survival depends on digitizing value streams i.e. Improving the customer experience by providing end-to-end digitized, automated and optimized solution as "a chain is no stronger than its weakest link". Due to this weak link, organizations are not able to determine the RoI of the investments made.

4. **Security:** Security and safety hasn't been the priority in designing and developing the IoT solution. According to the Ponemon Institute's 2017 Study on Mobile IoT Application Security only 30% of nearly 1,000 respondents said that their organization allocates sufficient budget to protect mobile apps and IoT devices. Protection from hackers as well as getting around potential security roadblocks like firewalls and existing network infrastructure has becoming one of the biggest hurdle in adoption of IoT by the masses.

5. **Connectivity & Downtime:** One of the most important component of IoT is connectivity and there are issues when device goes offline. 24x7 uninterrupted connectivity is still a dream in many of the developing countries and thus it becomes a challenge to monitor the device and hence provide the service in offline mode.

6. **Determining the KPIs:** As the primary motive of the IoT deployment is to gain the revenue through better customer experience, the biggest challenge when leveraging data for insights is around addressing the right KPI. What does the business want to know from data and then even bigger challenge is how do you feed it back to the business?

7. **Conveying value proposition:** Building a compelling value proposition and conveying it properly to the end customer before and during the launch is a challenge as they are just beginning to understand the realm of the possibilities. Convincing the customers to choose our product over plethora of devices available in market is what makes the industry less lucrative.

8. **Coordinating different stages:** During the launch, creating buzz, generating leads, driving sales, explaining use-cases, driving product trials to increase interest. During growth stage - leveraging data to understand users, creating tighter product market fit, nurturing users to increase engagement and sharpening personas, communicating vision, product capability to investors, analysts to maintain leadership position. Finally, during mature stage - continue to maintain leadership by highlighting competitive differentiators, engaging actively with power users are some of the challenges during the entire product lifecycle.

7.2 Industry best practices

In order to overcome the challenges presented in above section, it is important to follow the best practices suggested by the leaders in the IoT industry. Practices mentioned below are the exact quotes from the interviewers to give an undiluted version of their experience. Moreover, all are points are coherent and points towards a common strategy.

1. Identify top-down solutions that will involve orchestration of People, Systems, IoT, and potentially trading partners. No one buys IoT. Often organizations embark upon IoT just because it is a "hot" technology. This is a techie bottom-up approach. At the end of the day clear business objectives should drive the IoT strategy.
2. Ensure security is designed into the solution from the outset, not as an afterthought after successful Proof of Concept.

3. Make sure the IoT initiative meets the needs of intended user base.
4. Make sure new sensors/devices are simple to implement, using software and automation to drive provisioning as much as possible, as opposed to manual provisioning and configuration. Use generally supported standards that are likely to be around for the lifespan of the product.
5. Start with the business goals and work backwards from there. Always keep asking yourself what is the mission critical data your CEO wants to see. Once you know your business KPIs, think of a way of instrumenting the enterprise that will get this data. Start small but keep the focus on the data that you'd like to see. Everything else is trivial.
6. An IoT platform that is flexible is a must i.e. technology should not be a limitation.
7. Acknowledge that IoT is moving at a tremendous pace and be prepared to adapt product and assumptions at any point.
8. Determine where in the IoT value chain are your strengths. At the device level, or the middleware layer, or the data storage and processing layer and play to your strengths.
9. IoT is an ecosystem of technology, services, capabilities and users. Knowing where you can plug and play is useful to drive value.
10. Perform a risk assessment at the outset and layout the threat model for all the touch points.
11. Study the failures of others.
12. Don't discount the value of existing solutions, as low-tech as they may be. Companies fail because they believe too much in their own tech while failing to understand how companies make decisions and the psychology of decision making (i.e. loss aversion, probit vs. epidemic adoption, choice paralysis, etc.).
13. Focus on a well-bounded problem first. Don't try to develop a general-purpose platform.
14. Don't get trapped in the endless pilot loop. Some pilots are good, others will drain you of precious time and cash with no outcomes. Learn how to navigate an organization and assess their likelihood of adopting (even if your key stakeholder is ultra-enthusiastic). Build a culture that minimizes technical debt.
15. Management commitment: Carriers tend to lack a culture that champions innovation. The most successful IoT companies are "small" ones.

16. Begin with a data analytics vision in mind. This helps companies to design the foundational solution in such a way that an evolution from a basic M2M solution to a true IoT one is easier and faster.
17. Carve out a specific niche as IoT is a broad topic. Take an outside-in approach, define the market, needs and requirements first, get some initial insights to get some feedback and be agile in the process.
18. Having the right resources with the right skills during each cycle of the product design.

8. Conclusions & Recommendations

8.1 Conclusions

IoT brings with itself a huge potential to change the landscape of Product Marketing. In today's fast pace and cut throat competitive world, marketers are realizing the benefits of the technology and putting it to use to differentiate either their value proposition or to derive customer sentiments on real time basis to refine their offering. In the near future, it would be imperative for the companies to create a connected product build on a well-defined platform. IoT should be seen as a lens to the outside world which will help product marketers make an informed data driven decisions on real time basis. Opportunities considered as far-fetched such as tracking the assets outside the premises discussed in this thesis and many other would be in reach of the company and will open a wide landscape of opportunities.

As pointed out by the market leaders in IoT space, there are few challenges which a marketer must surpass to realize the true potential of this technology. Though the companies are now investing heavily, IoT is still in an infacy stage and it requires great deal of effort and caution to monetize it. There are lot many offerings, platforms, protocols, standards, making IoT extremely chaotic at the moment. Marketers must understand the product vision along with the strategy and should get involved during product design and development phase to help the team choose right technology, platform and protocol.

8.1 Recommendations based on Systems thinking approach

Here are some guidelines for the marketers based on the research conducted during thesis, system design principles learned during System Design and Architecture program and interview insights.

1. **Stakeholder Value Network (SVN):** In the beginning, once the product vision and strategy has been finalized, marketer must create a SVN diagram representing all the key stakeholders along with their goals and needs. Marketer must analyze the key KPIs related to each stakeholder to determine the success criteria. Creating an SVN help find the missing link and opportunities. It also helps in understanding the complex economic ecosystem and the dynamic relationships between the entities. The fig. 24 below represents one of the detailed stakeholder value network diagram created towards completion of the assignment related to

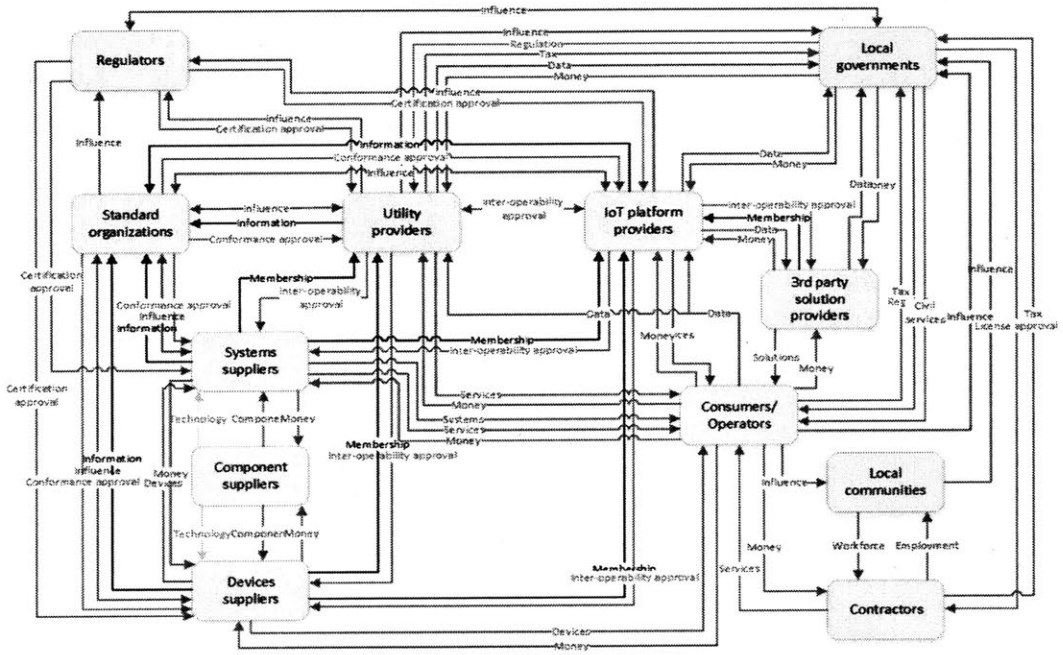

Figure 24 Stakeholder Value Network (SVN) for the Smart-Home project

2. **Project Charter:** Creating a project charter including the goals of the project along with the criteria on basis of which the success would be measured is imperative. It would help communicate project scope, intermediate deliverables and risks & assumptions with the stakeholders to avoid any miscommunications. It also clearly sets the expectations and boundary of the project. A well-defined charter helps the team

3. **User Research:** As customer is one of the most valuable stakeholder, conduct the customer research at the earliest once prospective opportunity is identified. Create a target persona and identify how the customer could be reached at minimum cost and develop a go-to-market strategy. Product roadmap and launch windows must align with the go-to-market strategies.

4. **Technology Readiness Level (TRL):** Since IoT involves the latest technologies concerning the sensors and communication, it is important to assign a TRL to better access the risk and plan mitigation steps in implementing a solution based on that technology.

5. **Key performance metrics:** It is a common saying that "If you don't measure it, you can't manage it". Frame important KPIs and measure them at regular intervals and especially after

the product launch to validate the hypothesis about the consumer as well as product success. The mantra for KPIs is to measure, refine and repeat it unless you get clear picture of the after-launch scenario.

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