The Internet of Things (IOT), Big Data and Customer Engagement

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Abstract

In the rapidly changed world due to the digital technology and other innovations, firms had more and more ways to get engaged better with both customers and supply chain partners than any time before.

In this study, the authors develop a framework to (a) Review the conceptualization of Internet of things, Big data and Customer engagement in the marketing literature, (b) Examine the relationship between Internet of Things (IOT), Big data and Customer Engagement. (c) Investigate whether the success in using Internet of things and Big data analytics would impact customer engagement. (d) Guide both managers and marketers to realize how IOT and big data can enhance customer engagement through adding value to the marketing activities that in turn leads firms to gain competitive advantage.

Keywords: Internet of Things, IOT, Big Data, Customer Engagement
Introduction

Internet of Things (IoT) is recognized as one of the most important areas of future technology and gained enormous attention from several industrial extents, the adoption of this technology is changing rapidly as industrial, societal, and competitive pressures drive firms to innovate and develop themselves (Lee & Lee, 2015). In due time, Internet of Things (IoT) used in business projects and became more concerned with the development of data management, leverage IoT infrastructure, and change business models than using basic sensors, devices, and smart things (Deloitte, 2016).

Apparently, data provide interactive understandings about customers that marketer can consider as a competitive advantage (Erevelles et al., 2016). Therefore, Data science emerged to focus on, capture, create, analyze and use big data streams (Johnston & Pattinson, 2016). Digitization allows information to be directly stored, accessed, shared and processed through digital circuits, devices and networks (Ng and Wakenshaw, 2017).

Big data regarded as the fourth business revolution, independent computerized manufacturing processes connected with the internet of things that will promote efficient, flexible and customized production (Breur, 2015). As a result, there is a strong motive to value significant changes in retailing areas due to recent innovations, so that we can better recognize the develop the future of retailing (Grewal et al., 2017).

Therefore, to make things easier for customers is all about using smart phone apps and websites. As soon as the Internet of Things (IoT) extends our engagement with businesses beyond the screen into our vehicles, stores and even our houses (Saxon, 2017). For example, Machine to Machine (M2M) connections is expected to raise tightly from 4.9 billion in 2015 up to 12.2 billion (Calif, 2016). One example to show the timely growth in using the internet and connected devices is that in 2015, Wi-Fi and mobile phone connected devices generated about 62% of internet traffic. By 2020, Wi-Fi and mobile phone connected devices expected to produce 78% of Internet traffic (Cisco, 2016).

Despite the progress in the internet of things IoT technology, several areas remain unexplored to date including the social, behavioral, economic and managerial dimensions of the IoT so, this represents a significant challenge for firms to adopt IoT (Lee & Lee, 2015). Likewise due to the extraordinary volume, velocity, and variety of primary data captured from individual customers we now are in the big data revolution era that will lead to entirely different ways of understanding consumer behavior and designing marketing strategy (Erevelles et al., 2016). Even though, there is an important value of big data to marketers; IoT offers enormous understanding into customer’s mind besides changing daily life operations by helping generate more efficient towns and creativities. As a result, both contexts of business (B2B) and customers (B2C) will gain competitive advantage from the IoT (Newman, 2016).

Basically, innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption and the five characteristics that determine an innovation’s rate of adoption are: relative advantage, compatibility, complexity, trial ability, and observability (Rogers, 2002).
A review of the existing literature on Internet of things, big data and customer engagement provide insights to why these concepts are essential. Traditionally, both the need to better understand customer behavior and the interest of managers focused on customers delivering long term profits changed how marketers viewed the world (Winer, 2001). More recently, firms face difficult challenges that make customer engagement more important than ever due to the severe competition that required achieving high engagement levels (Roberts & Alpert, 2010).

At this time, both marketing scholars and practitioners discuss, measure and examine how firms can benefit from customer engagement as these engagement behaviors also have value extraction consequences (lemon and Verhof, 2016). Specifically, Customer engagement that was used in the last few years as an outcome of the firms’ activates (Pansari & Kumar, 2017). As a result, the firms target developed from relationship marketing to engaging customers in every way (Pansari and Kumar, 2017).

Due to technological advances, customers today are becoming an important source of generating data either traditional structured, transactional data or current un-structured behavioral data (Erevelles et al., 2016). Besides, Supply chain inventories could generate massive amounts of data that companies can turn into intelligence through analytics used from POS, GPS, RFID to social media feeds, for instance, Amazon, and WalMart utilized well from the influence of big data analytics (Sanders, 2016).

Despite the fact that numerous studies in the marketing literature discussed how firms build customer engagement, identified its dimensions, the relationship between internet of things, big data and customer engagement had a lot unexplored yet.

Therefore, in this study, the authors aim to examine the role of the internet of things and big data in achieving customer engagement in the era of increasing data driven marketing and how it will impact the marketing discipline through discussing the opportunities of using the internet of things and big data in creating customer engagement.

In summary, the purpose of this paper is to:

- Synthesis the existing literature of internet of things, big data and customer engagement.
- Identify the conceptualization of the relationships between Internet of Things (IOT), big data and customer engagement
- Highlight the research propositions and create a framework to describe the relationships between variables.
Literature Review

1. Internet of Things (IOT)

Internet of Things (IoT) Concept

The Internet of Things (IoT) is a combined network of sensors connected to the internet, a web platform supported devices through sensors each containing IP addresses where, smart sensors collect and send real time information through the internet (Johnston & Pattinson, 2016).

Lee & Lee (2015) identified five IoT technologies that needed for the successful adoption of IoT to create products and services: radio frequency identification (RFID); wireless sensor networks (WSN); middleware; cloud computing; and IoT application software. wherever, mobile phone is an essential intermediary between things, people and internet (Mattern and Floerkemeier, 2010).

Internet of things (IoT) Current state

Currently, we still at the beginning of this technology movement, Specialists estimate that in 2015, there were 25 billion connected devices, and by 2020 they will be 50 billion (FTC, 2015).

More recently, Forbes mentioned the top 10 advances for Digital Transformation in 2017 are; adaptability to achieve continuous success, growing importance of user experience, quick innovation, hold the distant workforce, the creation of augmented reality (AR) and virtual reality (VR),big data and analytics, Digital transformation determined by the Internet of Things (IoT), Smart machines and artificial intelligence (AI) that are significantly successful and finally, destroying storage tower (Newman, 2016).

Internet of things (IoT) Growth Rates

Johnston (2014) identified some future estimates for the growths of the Internet of Things include (IoT):

- Demand for advanced logistics leading to RFID tags for facilitating routing, Inventorying and loss avoidance.
- Cost saving key for the diffusion into second movement of applications with Investigation, security, healthcare, transport, food safety, and document Management.
- Ability of devices traced at home to get geolocation signals that permit finding people location and everyday things.
- Reduction, power resourceful electronics and accessible scale bandwidth generating teleportation and telepresence which permit monitoring and controlling distant objects.
- Software representatives and innovative sensor merging the physical world to the Web.

In addition, the following statistics highlight the importance of Internet of Things (IOT):
The expected total economic impact of IoT will reach a range between $3.9 trillion to $11.1 trillion a year by 2025 (Mckinsey, 2015).

According to (Cisco, 2016) the expected growth rate in IP traffic according to different regional areas by 2020 is:
- 59.1 Exabyte/month for North America in 2020
- 28.0 Exabyte/month for Western Europe by 2020
- 17.0 Exabyte/month for Central Europe 2020
- 11.6 Exabyte/months for Latin America by 2020 and finally 10.9 Exabyte/month in the Middle East and Africa by 2020.

Not only IoT develops but also, the capacity of data generated grows as well. by some estimates, connected devices will generate 507.5 zettabytes (ZB) of data per year (42.3 ZB per month) in 2019 higher than 134.5 ZB per year (11.2 ZB per month) in 2014. (A zettabyte is 1 trillion gigabytes) (Deloitte, 2016).

By 2020, signifying approximately half (46 percent) of total connected devices Connected home M2M connections will increase from 2.4 billion in 2015 to 5.8 billion in 2020, representing nearly half of total M2M connections worldwide (Cisco, 2016). Similarly, by 2020, the expected number of IoT Sensors will be 50 billion and more than 200 billion Things on the Internet by 2030 (Newman, 2016).

Therefore, the previous statistics indicate that firms should focus on the benefits of using internet of things and how to use it in engaging customers.

**Internet of things (IoT) Major applications**

Rogers (2002) specified four main elements in the diffusion of new ideas which are innovation, communication channels, time, and social system.

An example of IoT technologies that used in several areas: security (access control, security care for elderly, time reporting for home care), tracking and tracing (fleet management, logistics for goods transportation), payment (mobile payments), health (e-home care), remote control and maintenance (Smart houses, environmental monitoring) and smart power grids (Andersson and Mattson, 2015).

Indeed, IoT holds remarkable opportunity to change not only industrial manufacturing but other businesses too for instance, a recent innovative business is Uber that used location technology and mobile phone abilities, once customer need to ride the driver gets a notification and determine the arrival time, fare and length of the tripe (Breur, 2015).

According to (Lee & Lee, 2015), there are three IoT sets of business applications: first, monitoring and control Second, big data and business analytics, and finally, information sharing and collaboration. Understanding how these three IoT groups can increase the customer value of a business which is essential to effective IoT acceptance. For example, Siemens firm in Germany where, machines, and computers, include about 75% of the value chain only, with some 1,000 computerization controllers in operation all over the production line. Every part manufacturer has a product code that allows machines to determine its output requirements and the subsequent steps (Deloitte, 2016).
2. Big data

Big data consumer analytics "are the extraction of hidden sight about consumer behavior from big data and the exploitation of that insight through advantageous interpretation" (Erevelles et al., 2016, p.897).

Big data created in and across networks so, there is no strict established definition for big data, but (Johnston & Pattinson, 2016) reviewed big data previous studies and outlined the five V's of big data which are Volume, Variety, Velocity, Veracity and Value.

Whereas, Volume is the amount of data produced every second (Johnston & Pattinson, 2016). Velocity is relentless of the data generated; Variety includes different sources of data as structured data, unstructured or semi structured data (Erevelles, 2016). Veracity is the uncertainty of data and finally, Value, the proficiency to turn data into business value (Johnston & Pattinson, 2016). Therefore, (Sanders, 2016) stated that big data with analytics creates the ability to have a significant vision that turns information into intelligence and big data without analytics is relatively a huge amount of data. On the other hand, analytics without big data are considered only as statistical and mathematical tools that existed for years for instance correlation and regression. Obviously, Analytics are the tools that help in finding unknown data outlines (Erevelles, 2016).

Big data and Internet of things

The Internet of Things (IOT) has the potential to increase the volume of Big data exponentially due to, devices and machines used directly by persons as ATMs or what individuals depend on as traffic signing systems that exchange internet messages among each other (Breur, 2015). The issue of storing, securing and analyzing IoT data is significant for informed marketing activities. Insight into customer behavior in real time will be greatly enhanced through analysis of data flowing constantly from IoT sources. The question is will the cost for all potential applications produce value in the marketing relationship. While there are an unlimited number of applications many that are feasible will not produce the value required. A few areas of consumer product applications (e.g., transportation, health care, and smart homes) will be worth the effort. In business-to-business applications customer engagement will yield significantly more worthwhile applications in customer engagement and efficient operations (Industry 4.0 manufacturing ecosystems, JIT maintenance and service, and servitization value propositions).

Therefore, Big data analytics is not just a new technology. It is the link to software, computing, and technological competencies that led to an era of profoundly different competition and is a technology interference of significant scopes (Sanders, 2016).

3. Customer Engagement

There is a growing concern that customer-centric strategies regarded as important issues for both academic researchers and marketing practitioners due to the shift from company centric to customer centric marketing approach (Javornik&Mandelli, 2012).
Moreover, Managers are increasingly aware that long term quality relationships between company and customers can be a major source of profitability (Kumar et al., 2010). Consequently, the more the value that the company provided to its customers the more they retained (Wong, 2013).

Initially, the engagement concept has a conceptual root in fields such as psychology and organizational behavior while emerged in the marketing literature recently (Hollebeek, 2011). Meanwhile, (Bowden, 2009 & Brodie et al., 2011) defined engagement as a sequential psychological process to become loyal to a brand. Research indicated that engaged consumers showed greater loyalty to brands (Hollebeek, 2011). Consequently, Customer engagement studies focused on differentiating between customer attitudes and behaviors that go beyond purchase (lemon & Verhof, 2016).

On the one hand, (Vivek et al., 2012) stated that customer engagement is the intensity of an individual's participation in and connection with firms' offerings or activities. On the other hand, (Verhoef et al., 2010) considered customer engagement as a behavioral manifestation toward the brand or company that goes beyond transactions.

These beyond purchase behavioral dimension of customer engagement includes manifestations, such as co-creation, social influence through word of mouth and customer referrals (lemon & Verhof, 2016). Whereas, (Van Doorn et al., 2010) stated that engagement is a behavioral manifestation towards the company or a brand beyond purchasing and as a result of motivation.

This perspective used mainly as the digital and social media revolution has supported the importance of customer engagement behavior as customers become active co-produces or put an end to value for firms (lemon & Verhof, 2016).

Thus, the first proposition, \( P1 \): There is a positive relationship between digital and social media and better understanding of the customer journey to improve customer engagement.

Engagement is further seen as a way to generate customer interaction and participation (Kumar et al., 2010). Besides, Hollebeek (2013) stated that engagement would occur between the customer and product, brand or company. More recently, (Pansari & Kumar, 2017) defined customer engagement as the mechanics of customer value added to the firm either through both direct and indirect contributions. Therefore, more studies conducted lately to measure engagement value dimensions particularly, customer referral value and customer influence value (lemon & Verhof, 2016).

Nevertheless, (Hollebeek, 2011 & Brodie et al., 2011) stated that antecedents of engagement are involvement, interaction and absorption where engagement consequences are value creation, brand experience, and perceived quality, customer's satisfaction, empowerment, trust, commitment, value and brand loyalty.

Additionally, (Brodie et al., 2011) stated that engagement process had an iterative nature means that consequences of engagement may subsequently perform as antecedents. Similarly, (Gummerus et al., 2012) confirmed that as an ongoing relationship it's difficult to separate antecedents of customer engagement from moderators and consequences.
Analysis of CRM data can be used to drive optimization of customer life cycles; improve operational efficiency and integrate value chain collaboration creating a more customer-centric relationship of marketing activities. Furthermore, (Pansari and Kumar, 2017) indicated that after the relationship formed based on trust and commitment, the next level is customer engagement.

Thus, we propose that P2: There is a positive relationship between customer relationship management via analytics, operational efficiency, value chain management and customer engagement.

Whereas (Kumar et al., 2010) proposed four core dimensions for customer engagement value: customer lifetime value, customer referral value, customer influence value and customer knowledge value. Researchers agreed on three dimensions for engagement cognitive, emotional and behavioral (Brodie et al., 2011 & Hollebeek, 2013). While, (Vivek et al., 2012) added one more dimension which is the social aspect. Evidently, several studies examined customer engagement whether focused on attitudes, behaviors or value extraction (Lemon & Verhoef, 2016).

Eventually, Deloitte (2014) report presented sustainable customer engagement framework, where sustainability regarded as a value proposition for the potential increase in customer engagement as it increases customer loyalty, advocacy, and repeat conversions. Similarly, (West et al., 2015) identified the reasons to gain sustainability through customer engagement and achieved considerable growth regarding money, profitability, revenue and relationships which are:

- Transparency engagement: visible efforts companies made to inform the customers of the sustainability performance of products.
- Partnership engagement is to improve sustainability by attracting customers to participate in collaboration with the third party business actively.
- Lifecycle engagement: where the company attempts to engage customers during the entire lifecycle is a product.
- Collaborative engagement: business used modern network technology to create typical customer value.

So far, newer technologies include Internet of things or robots, business models, big data and predictive analytics propose that the shopping process is on the edge of a significant rise due to the fast retail setting development. However, consumers’ needs still drive their purchase decisions (Grewal et al., 2017).

Value creation, Internet of things (IoT) and Customer Engagement

Technology provides broad vertical and horizontal information sharing in addition to collaboration between department and network partners that sustain product and service implementation strategy (West et al., 2015). In fact, Changes caused by the Internet of Things are either incremental or transformative however there is a need to capture value remains as it finely tuned (Raynor & Cotteler, 2015). Moreover, Value creation argued as
digital business services that can be recognized and datafied through Service Oriented Architecture (SOA) or in another expression the information Services Platform (Johnston & Pattinson, 2016).

To illustrate, (Raynor and Cotteleeer, 2015) identified five stages of information value creation showed in figure (1) that outlines information value loop: Firstly, create: using sensors to generate information near a physical event or state. Secondly, communicate: transmit information from one place to another. Thirdly, aggregate gather of information created at different times or from different sources. Fourthly, analyze: make a decision of patterns or relationships among spectacles that leads to descriptions, predictions, or prescriptions for action. Finally, Act: Initiating, maintaining, or changing a physical event or state.

Accordingly, revealing such information resources can not only build engagement and transactions with customers about the product functions but also product's position, action and image this is due to customer relationship with the product (Ng & Wakenshaw, 2017). Equally important, Customer value is B2B marketing central concern as marketer continuously under pressure to ensure that customers obtain value from the suppliers' offer (Wiersema, 2013).

Therefore, the third proposition P 3: In some cases the customer will not be required to interact directly with the manufacturer but rather customer specific automated service functions supported by the algorithm driven processes in place there is a positive relationship between internet of things and customer engagement.
Figure 1: Information value loop


Value Creation, Big data and Customer Engagement
According to (Mazzei&Noble, 2017), there are three levels of value creations due to big data trend firstly, Data as a tool, secondly, Data as an industry and thirdly, data as a strategy. For instance, Amazon.com trying to build engagement relationship with its customers by creating Amazon dash which is a device that can be attached with one of the products chosen by a customer and allows this customer to reorder that product by just pushing the button (Venkatesan, 2017).

Erevelles (2016) provided examples of how big data create value in the marketing mix over the place. In addition, fewer studies showed that various marketing activities influence customer engagement and that customer engagement could impact the firm's performance (Pansari and Kumar, 2017).

Hence, the fourth proposition P4 is: Data from social media, CRM system and IoT sensors will generate large quantities of customer behavioral data that can be used in aggregate or with specific customers and there is a positive relationship between big data and better informed marketing activities

For example, Amazon’s preemptive shipping and promotion; using geospatial data in advertising messages, product; Ford motors using customer analytics for about four million vehicles to revolutionize its innovation and design. Currently, retailers can use big data effectively to predict consumer behavior, design more attractive offers, reach their customers better and build up ways to make customer support their products thus retailers can use multiple ways of technology to engage customers (Grewal et al., 2017). Since customers continually engaged at different levels with the company and social networks (Venkatesan, 2017).

Thus, the fifth Proposition P5: There is a positive relationship between big data better informed marketing activities and customer engagement.

Conceptual framework

The current study proposes a robust framework for studying the relationship between Internet of Things, Big Data and Customer Engagement as shown in Figure (2).

This framework designed to highlight the key concepts in the reviewed literature; we explain the concepts of Big data and identify its components as Customer Relationship Management (CRM), Social and digital media and Internet of Things (IOT), that firms can use one or more or even all of these data when deciding to develop marketing practices or activities and how these marketing efforts would help customers to better understand firms' offerings, evaluate marketing activities and in addition firms can achieve customer engagement. This framework mainly based on the relevant literature.
Figure (2): Framework for the relationship between Internet of Things, Big Data and Customer Engagement
Discussion

In this study, we present a framework that allows firms to benefit from using big data and internet of things to engage their customers. As, we provide a strong theoretical foundation for how big data and internet of things can positively impact customer engagement. Despite the importance of using big data and internet of things (Lee & Lee, 2015) identified five technical and managerial challenges that firms would face, data management, data mining, privacy, security, and disorder.

Nearly, privacy risks resulted from collecting personal information, habits, locations, and physical conditions over time, thus, IoT allow collection of sensitive behavior patterns, which might be used in informal ways or by unauthorized persons (FTC, 2015).

Managerial implications include identifying those applications and customers that will generate the necessary improvement in customer engagement to drive the increase in value for the required marketing activities and the management and analysis of the data.
References


