Factors Influencing the Use of Internet of Things (IOT) in Grocery Shopping in Pune

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Abstract

With self-driving cars, virtual assistants and smart carts helping consumers buy products, to fully automated hotels having few or no staff present in them, the world is spurting up with the Internet of things (IOT) technology in full swing. This paper attempted to detect the factors influencing the use of IOT in consumers buying grocery in Pune. The study was conducted as compared to five factors influencing the usage of IOT while shopping that is engagement, availability of variety, self-service, real time data availability and product quality information. Data was collected from 260 respondents residing in Pune by means of an online survey. The research shows that amongst the five factors "engagement" was the highest valued factor with a variance of 19.176%, followed by product quality information, self-service, real time data availability and availability of variety all in decreasing order of variance. The findings of this study aim to contribute the vital stats to the companies who are working on researching, designing and preparing product which are a constituent of IOT and retailers who are planning to enhance their customer and market reach strategy.

Keywords: Internet of Things (IOT), engagement, availability of variety, self-service, real time data availability, product quality information

Introduction

Kevin Ashton was the first person to coin the term Internet of Things (IOT) in the year 1999(Ashton, 2009), and earlier IOT was also often referred to as "embedded internet". But, this technology truly gained its momentum since 2011. IOT in a broader sense is used to refer to interconnected virtual and physical objects together. These components of IOT can easily transfer data without the aide or influence of a mediating agent such as humans. In the IOT techno-sphere regular day to day objects are transformed into "SMART" objects which are enabled to sense, decipher and react to the external environment using a technology called Radio-frequency Identification (RFID), sensors embedded in objects, integrated chips and real-time localization (Amaral, 2011).

As per a report by Accenture, "The IOT will be disruptive mostly in the retail industry", and the synthesis of technology and retail empowered by IOT is going to see a remarkable effect

in the overall advancement of this industry. Grocery retailers have been striving to formulate the correct formula to provide a seamless experience while shopping for their customers which would help in escalating their sales and surging the loyalty of their customers, but have not been able to do so yet, because every customer has unique demands and requirements. The devices which are connected to IOT such as smart shelves, digital signage, video camera, beacons, etc. are the solution to the aforementioned problem, as this technology enables all the connected objects to accumulate, store and examine enormous amounts of data, collected on a daily basis about the customer activity giving us sophisticated insights and reports. These data are being collected and analyzed to improve the efficiency and effectiveness of the store, its layout, engagement generated by a product and the increase of interactions using digital kiosks, etc. Virtual and digital assistants like smart carts enable the customer to look for the products on their list, generate awareness about new products, promote offers and discounts specially curated for the customers. And these IOT data are a boon for marketeers as they help in the measurement of promotion success making it simpler and precise on real time basis. IOT will provide a performance metrics enabling store managers to do away with any queues, scheduling staff with the use of cognitive intelligence, and maintaining the service level uniform all throughout to meet the customers expectation providing a unique experience and making them feel delighted. (Gregory, 2015). Hence IOT is about to present a greater opportunity for the development of retail infrastructure and reorganization of its existing sales and promotion strategy. This will also be a good opportunity for retail industry to improve their market research and reach overall. A study conducted on the predictable influence of IOT on higher education, depicted that the properties like flexibility, hyper-connectivity, adaptability, scalability and accessibility between real and virtual objects are the major properties of IOT and hence facilitating the efficiency of e- learning (Abbasy & Quesada, 2017), likewise when shopping with IOT is considered, IOT acts as good medium for increasing efficiency and providing convenience to the shoppers. Erstwhile research conducted on the impact of IOT on grocery shopping also indicated that IOT service provided on the factors such as date of expiration, index of product quality, offers and discounts had a favourable impact on the exploration and likeliness to purchase the product, in turn benefiting the retailers to a greater extent (Fagerstrøm & Sigurdsson, 2020).

Literature Review

In simple words Internet of things (IOT) is a set of smart gadget connected to a series of other devices which share information and data forming a large network of interconnected devises providing and collecting data on real time basis. These devices are enabled to collect and exchange data through embedded sensors and/or radio frequency identification (RFID) (Abbasy M. &., 2017). This operation is achieved by seamless ubiquitous sensing, data analytics and representation of information over the cloud in a unified framework (Gubbi, 2013) . An example of IOT application can be seen on self-driving smart cars, which have the ability to access information on real time traffic, road condition, weather, etc. and technologically advanced supermarkets which are highly automated and run by robots which are extremely collaborative in nature and are generally called (cobots). This technology is looking forward to take advantage of the limitless automation and big data security, advanced and progressive policy associated to technology and responsible application of science, enabled by 3D symmetry in innovation ecosystem design has come to be known as Industry 5.0 (Özdemir, 2018). IOT is one of the emerging trends and is lending a big hand to the development of technologies belonging to Information and Communication Technologies (ICT) sectors (Miorandi, 2012). IOT finds its applications over a wide

array of domains, and can broadly be grouped under transportation, logistics, health care, smart environment (home, office, retail stores) and lastly personal and social interaction(Atzori, 2010). The advent of advanced technology has led to digitization which in turn has led to the merger of touch and feel information in the real world enabling the traditional retail industry to adopt Omni-channel retailing (Brynjolfsson, 2013).This transformation on one hand has seen a change in the consumer buying behaviour by providing a holistic customer experience with the integration of technology for the users such as free Wi-Fi, screens which are interactive, augmented and virtual reality, intelligent self-service kiosk, QR codes, virtual mirrors, etc., (Mosquera, 2017) while on the other hand provides immense benefits to the retailers by optimizing their supply chain operations, attracting and connecting with more customers and creating new opportunities to generate revenue. IOT in retail industry provides necessary resources for customers to co-create value, i.e.; provision of smart phone apps or "SMART" shopping carts providing real-time information updates, location of products, and related products suggestions all in all creating a personalized shopping experience. Hence, making value co-creation possible (Balaji, 2016).

This study is conducted to comprehend the factors influencing the use of IOT in grocery shopping no consumers residing in Pune, the factors for which are explained in detail below:

Engagement in Shopping

As per some marketing scholars, engagement is considered to have a multidimensional facet, wherein the dimensions of cognitive, emotional and behavioural intelligence converge to attract, retain and engage customers (Bowden, 2009) (Calder B. J., 2009) (Hollebeek, 2014) (Mollen, 2010). Then there are some which are of the opinion that engagement is a unidimensional facet, driven by customer's motivation to interact and engage with the object in focus, based on their past experience with the medium, service or brand (Calder B. M., 2009)(Thakur, 2016). Essentially consumer engagement in shopping is one of the key factors to be considered because it helps investigate the sustenance of competitive advantage for a retailer (Dulabh, 2017) and provides a large data set of information regarding the type of products and brands preferred on a routine basis by the customer reflecting the association, loyalty and goodwill with respect to that brand, product or store.

With IOT assisting the shopper in making various purchase decisions, it is to be noted that the ultimate decision maker will be the customer, and hence it is vital to know what catches the attention of the customer. The data derived in terms of engagement can then be used by the retailers to adopt these new strategies to promote their products and capture the customers' real time feedback.

Availability of variety

Humans by nature have a tendency to seek opportunity to experience or explore newer things and same is the case with a consumer, more the variety more is the appeal and proximity to making a purchase (Sharma, 2010). In reality IOT will make the consumer spoilt for choice. Ideally a consumer, specifically a variety seeking customer will have a great time exploring newer products since IOT will be able to retrieve data and

provide suggestions for making the next purchase as per the users browsing history or any specific purchase that you may have tagged. It is thus necessary to know how new and diverse connections between virtual and physical objects bring about a change in the consumers buying behaviour (Gregory, 2015).

Self-service

In the era of digitization and automation along with the fast-paced lifestyle people generally prefer things such as daily shopping or grocery shopping to happen in a jiffy and in the coming future this is likely to be more pronounced. With the availability of the IOT technology the consumers will be rest assured that the things they need are all notified to them in advance along with the nearest store where they can find it, all in real time. In such a scenario it will be the online assistants or robots that will be assisting the customers, whom the customers can chose as per their preference form their appearance to their gender, (Payne, 2013) as a result of which excess manpower in these areas will be greatly be reduced eliminating any scope of human errors and optimizing time.

Real time data availability

Real time data analytics is a trending field and with every progressing day it is being readily adopted from airports to hospitals and also our mobile phones, simply due to the collection and generation of large set of data by users like you and me. With the IOT in place it will be absolutely convenient for a customer to figure out if the product they are looking for is present in their nearest store or their preferred online retailer, what is the current usage of electricity in their smart homes, etc., all due to the real time data analysed with the help of networks that are hyper-converged, architectures which are enabled to perform parallel mining and edge analytics for you instantaneously by your smart devises fitted with sensors (Verma, 2017).Also consumer specific offers, deals and sale can be provided to consumers who are promotion-sensitive (Zhang, 2009) using real time data analytics.

Product Quality Information

A customer is always in search of the best quality and technology will be a boon to them and not just that it acts a key positive indicator of customer satisfaction (Guo & Liu, 2012) which is why the devise used by the consumer enabled by IOT technology will be capable of giving the aggregate national customer experience index which is very valuable in terms of quality comparison and awareness (Fagerstrøm & Sigurdsson, 2020). IOT technology will be able provide suggestions to a customer regarding the shelf life, microbial and fungal content, nutritive value, probable allergens, radioactive element, acceptable intake, calorific index of the food (Bouzembrak & Marvin, 2019) or the size, colour, style of the fabric all based on your needs and data available to the device as soon as they pick up the product.

Our aim in this research paper is to present a predictive analysis of the above factors which will be influencing or encouraging consumers to use IOT technology while of shopping in the near future. This information will be useful for the science or technology-based companies or industry to make devices or apps catering to the highest ranked factor in this study, it will also help the supply chain and retail industry to

understand the ways and means of customer demand-supply and psychology respectively.

Methodology

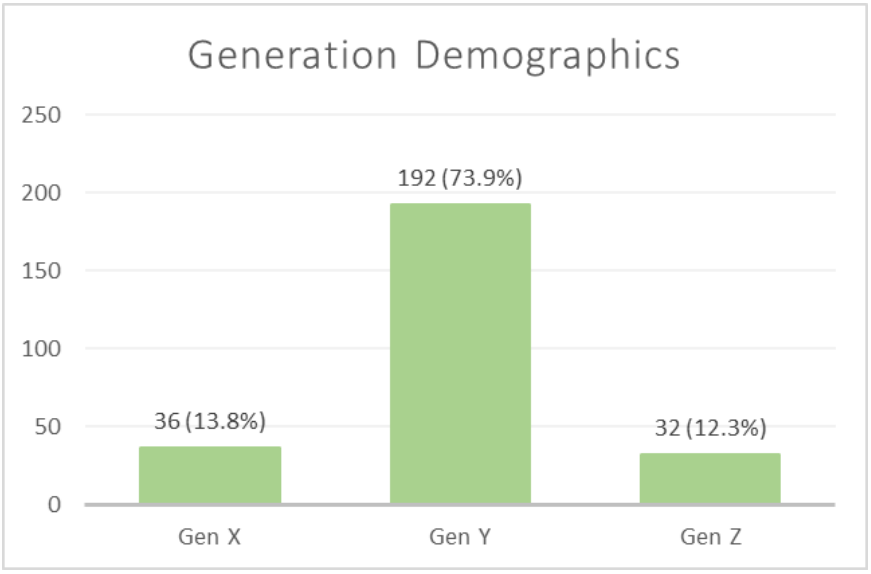
Measures

The variables in this study have been measured by the items that were carefully chosen and adopted from pre-existing literature. Three items measuring each variable i.e., engagement, availability of variety, self-service, real-time data and product quality, from which engagement and self-service factors were adopted from (Abbasy & Quesada, 2017), the factors like availability of variety, real time data and product quality were adopted form (Fagerstrøm & Sigurdsson, 2020) and (Guo & Liu, 2012), ultimately leading to find out, what factors influence a shopper to use IOT for grocery shopping. All the items were estimated by a Likert scale, having five-pointers, wherein (1) defines "Strongly disagree" and (5) defines "Strongly agree".

Data Collection and Sample Selection

The study adopted a quantitative analysis method in which data were gathered from the respondents who belonged to the generation group of Gen X(1965-1980), Gen Y/ millennials(1981-1997), and Gen Z (1998-present) based in the city of Pune. The survey was conducted using convenience sampling method. Questionnaires were floated online, using Google forms, distributed through email and various social media platforms to the first known respondents and further were requested to be distributed to further respondents. A total of 300 surveys were returned in a span of three weeks out of which 40 were incomplete therefore the study was conducted for only 260 valid responses.

Out of the 260 respondents surveyed, 51.5 percent were female, and 48.5 percent were male. 73.9 percent of the respondents are lying in the age generation of Gen Y / Millenials (1981-1997), 13.8 percent were Gen X (1965-1980), and 12.3 percent were lying in the range of Gen Z (1998-present), as seen in Graph 1. Annual household income was classified into three groups: up to ₹ 5 Lakh (6.1 percent), ₹ 5-10 Lakh (30.70 percent) and above₹10 Lakh (63.00 percent). Out of 260 respondents, 160 (61.53 %) are students, 72 (27.69 %) are full time employed, 16 (6.15%) are part time employed and 12 (4.61%) were unemployed.



Graph 1: Distribution of respondents over generations

Data Analysis and Results

Descriptive Statistics and Reliability Analysis

Table 1 shows the results or the descriptive statistics performed on the collected responses. The average of the individual scores were calculated to derive the final score of the variables. Among the five variables, self-service has the highest mean (M= 4.1910, SD= 0.9843).

Table 1: Descriptive statistics

Variables(Cronbach's Alpha)	Mean(M)	Standard Deviation(SD)
Engagement (α= 0.976)	3.4733	1.1011
Variety (α= 0.810)	3.6718	1.0087
Self-Service (α= 0.872)	4.1910	0.9843
Real Time Data (α= 0.874)	4.1512	0.8692
Quality (α= 0.865)	4.1615	0.8211

The respondents show higher preference towards self-service and especially towards the sub factor of automatic instantaneous billing (M = 4.4654, SD = .91889). The Cronbach's alpha (α) was calculated for reliability analysis, as depicted in Table 1. As suggested by (Hair Jr, 2010), the value of Cronbach's alpha must lie above the threshold value of 0.7, and the value in this study for all the variables ranged from 0.810 to 0.976.

Exploratory Factor Analysis (EFA)

An EFA was conducted for the items measuring the five factors namely: Engagement, Availability of variety, Self-service, Real time data availability and Product Quality using Principal components with Varimax rotation.

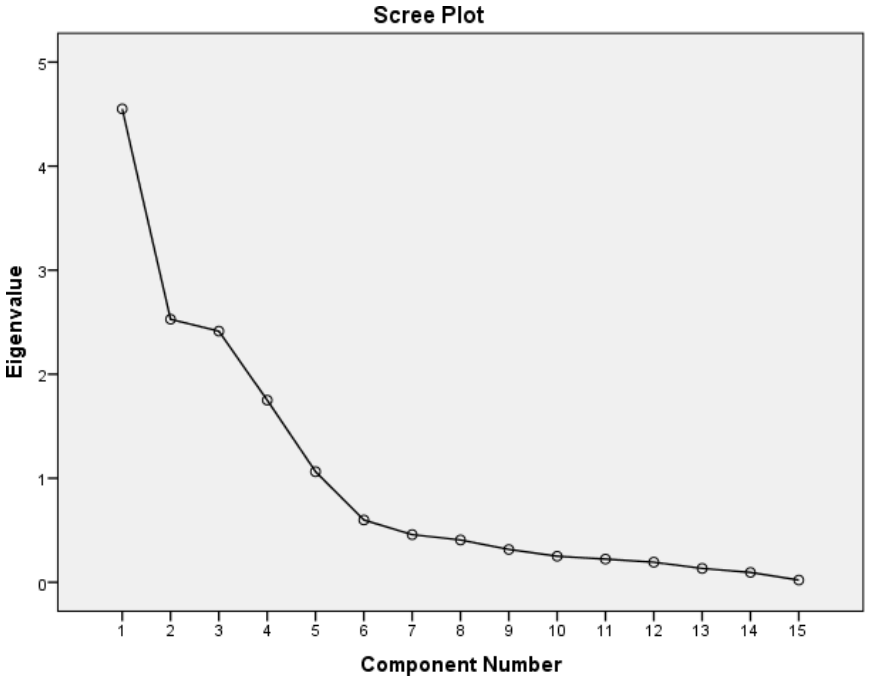
Table 2: Results of exploratory factor analysis

Factors	Loading	Eigen Value	Variance Explained
Factor 1: ENGAGEMENT (0.976)		4.550	19.179 %
Connecting all possessed devises to IOT	0.942		
Using virtual assistants while shopping	0.924		
Smart device guidance and engagement	0.959		
Factor 2 : PRODUCT QUALITY INFORMATION (0.865)		2.528	16.129 %
Nutritional and health information of product	0.836		
Aggregate customer experience and ratings	0.927		
Certified authority ratings and Quality Checks	0.910		
Factor 3: SELF-SERVICE (0.872)		2.414	16.043 %
Connected devices pre - ordering products	0.877		
Notifications alerts by devices to make purchases	0.922		
Instantaneous billing on inserting product to cart	0.860		
Factor 4: REAL TIME DATA AVAILABILITY (0.874)		1.751	15.953 %
Product price update on real time basis	0.858		
Personalized offers/discounts on products you are likely to buy	0.854		
Data on product comparisons	0.873		
Factor 5: AVAILABILITY OF VARIETY (0.810)		1.063	14.733 %
New product suggestion	0.697		
Alternative product suggestion	0.853		
Exploring new store locations	0.854		
Total variance explained			82.037 %

The results revealed that the KMO value was 0.746 and the 0.000 significance level shown by Bartlett's Test, demonstrating that the data was valid for exploratory factor analysis. The five components with Eigen values greater than 1 as shown in Graph 2 were pulled out, and the total variance explained by the variables was 82.037 %. All factors loading were above 0.5 as illustrated in Table 2. The first factor was "Engagement" which accounted for 19.179 % of the

variance being the highest among all the factors with an Eigen value of 4.550. The second-factor "Product Quality Information" captured 16.129% of the variance with an Eigen value of 2.528. The third-factor "self-service" captured 16.043% of the variance with an Eigen value of 2.414, the fourth-factor "Real time data availability" captured 15.953% of the variance with an Eigen value of 1.751, and lastly the fifth factor “Availability of variety” accounted for the least 14.733% of the variance with an eigen value of 1.063.

Out of the five factors these three factors "Engagement", "Product Quality Information" and "Self-service" captured 51.351%, which is more than 50% of the variance, contributing to the reasons why people in Pune would prefer to use IOT of grocery shopping.



Graph 2: Scree Plot showing four factors with Eigen values greater than 1

Discussion and Implications

There have been many a research conducted on the predictable influence of IOT technology in our daily lives but a very few depicting the factors influencing the use of this technology by consumers. This study is among the first of its kind that has researched the vital factors which lead one to use IOT technology from a consumers point of view mainly focused in Pune.

Pune is one of the hub of technology and advanced lifestyle in India. There are large job opportunities available since the student circle is large and diverse. Hence, this IOT technology will be a major game changer in advancing the lives of people who live a fast paced life and are already ahead of their time.

As the results suggest that “Engagement” is the top most preferred factor amongst all with a variance of 19.179% it is clearly seen that customers are reflecting their association, loyalty and goodwill with respect to that brand, product or store that they are planning to buy. Engagement is not just the customer’s interaction and awareness of the product but also to a certain extent the interaction with the IOT interface or devices they are using to gain the vital information that they want about their product. The engagement for every person is unique and the device can curate and modify a new form of engagement based on a particular user as per their needs. Taking a look at the second most important factor “Product Quality Information” with a variance of 16.129%, it is seen that just like in the previous literatures available on IOT based grocery shopping, this research also indicates that consumers are greatly focused on this factor since the factor is the biggest deal maker or breaker. For instance in simpler terms, a consumer will any day prefer a better quality product in comparison to an inferior quality because they are paying for it and want the best from the rest. Similarly if we see the third factor “Self-service” with a variance of 16.043%, it is at par with the factor “Product Quality Information” depicting this factor is equally as important to the respondents and the overall consumers, largely the Millenials in our study. Now, this result also shows how millennials prefer being on their own and take advice from sources which are highly reliable and instantaneous. The millennials are inclined towards a wholly automated environment, consisting of network of things connected with each other providing an easy flow if information which is boosted by artificial intelligence. Since most of the respondents were millennials and through their responses, they indicated that IOT will mostly be used for Engagement, Product quality comparison and self-service criteria which among all the five factors contribute to over 51 percent of variance. The findings hence depicts that people have scarcity of time and prefer doing thing on their own. Thus IOT will be a boon to their lives by providing them with benefits in terms of the aforementioned factors. The millennials prefer to lead a life dependent on technology in order to avail the correct and wholesome solutions to their daily life problems in the most efficient and sophisticated way possible. The other two factors namely “Real-time data availability” with a variance of 15.953% and “Availability of variety” with the variance of 14.733%, even though were not present with the highest variance have shown a remarkable significance as shown in Table 2. All the five factors of influencing the use of IOT show 82.037 percent of the variance, which means these five factors are the most crucial and important factors influencing the use of IOT in general.

This study shows that IOT services will provide convenience while shopping for groceries. However, the grocery retailers must wisely think about adopting and investing into the IOT technology to secure a competitive advantage over other players in market.

This study's outcomes also have a lot of inputs to offer to various companies and organization that may plan to come up with products well suited for customer use in providing IOT services. This study also acts as research, design and production solution for companies ideating and formulating on futuristic devices and softwares. This also acts as marketing inputs to companies promoting the idea of using IOT in the coming future.

Future Research Directions

This study can be conducted in a broader way in order to gain more significance and to expand the current study’s perspective. The sample studied might be one-sided due to the usage of convenience sampling consisting mostly of millennials. Simple random sampling can be use by future researches which is a part of probability sampling technique, where one can analyze by taking into account several different age groups in order to address the limitation. It would be recommended to gather information from a greater sample size, in order to increase the

significance of the study's findings. The future research can also improve this research by including security feature and other potential factors as in the use of this technology, which can lead to evaluate the possible advantages and challenges in the implementation of this technology.

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Ethical Approval

Not applicable

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