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Internet of Things for Different Types of Retail Formats

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Abstract
Technology centered businesses are highly motivated and accepted in the present Information age. More and more organizations are trying to introduce ICT in their daily operations and making their business leaner and flexible. Brick and Click Retail formats like hypermarkets, specialty stores and Convenience stores are using technological platform, like Internet of Things (IoT) for widening their reach to the customer. This piece of research tries to show the relationship between the cost and the strategy of a retail format with the adaptation of IoT in their operations.

Keywords
Brick and Click Retailers, IoT, Retail Formats, ICT, Technology adaption

1. Introduction
In the age of modern technology where the life cycle of product is decreasing with a multiplying factor and the technology is becoming obsolete so frequently, the retailers need to keep pace with the changing market scenario.
In past decade, retail sector has grown rapidly as compared to other sectors. Various formats of retailing have been introduced time to time which helps to cater the large variety of products amongst the existing and the potential market. With the boom of e-commerce and variety of products in the market consumers as well as retailers have shifted to a new age of retailing which brings the experience of buying and purchasing to next level, generally known as '***brick and click***' model. In this model, the time and physical constraint has been removed which helps the stakeholder to choose the convenient way of buying and selling.
One of the most trending topics in Information Technology (IT) sector is Internet of Things coined by Kevin Ashton from P&G. IOT tries to reduce human intervention and tries to promote devices' interoperability, that is why it's been accepted by most of the organizations. Internet of things refers to communication and sharing of information amongst real life objects through internet (Ashton, 2009). This paper researches about how IOT implementation will benefit the retail organizations.

2. Literature Review

2.1 Retailing
Retailing is one of the largest and the fastest growing Industries of the world. This growth has accelerated more in the last decade. Retailing involves those companies that are engaged in procuring products from the manufacturers and reselling the same goods to the consumers. Retailers are trying to be more consumer oriented and building personal contacts with them by exploiting insights into consumer preferences and behavior. (Kumar, 1996)

'**Brick and Mortar' Retail Format**
(a) Convenience Store - The size of Convenience stores (c-stores) is determined by the variety of products that they store. They can be as small as a kiosk with a size of around 800 sq. ft. or as vast as 4000 to 5000 sq. ft. The items stocked by convenience stores are the daily use products. Most of the sales of convenience stores come from

refrigerated goods (Kirby, 1986). Some of the best convenience stores are 7-Eleven, am pm, Family Mart, SPAR etc.

(b) Hypermarkets - Hypermarkets are self-service retail formats that provide a vastly wide variety of merchandise for the consumers to choose from. These establishments are generally larger in size and cover 1, 00,000 sq. ft. or more floor space in a retail outlet. Their business model focuses on high volume and low margin sales. They stock around 35, 000 to 60, 000 Stock Keeping Units (SKU). Food items constitute around 60 to 70 percent of the total sale of hypermarkets (Castrillo, Mira, & Gurdjian, 1998). The most popular example of hypermarket are Wal-Mart stores, Carrefour etc.

(c) Specialty Stores - Specialty stores offer a vast array of product for every category of the goods that they deal in. They predominantly cater to high-end customers but some provide for mass-consumer segment as well (Datamonitor, 2009). They are generally small in size whereas the size can vary from large to small depending upon the type and category of the product. These are highly specialized stores with limited assortment of products. Some examples of specialty stores are Swarovski, Archie's, Toy's R, Nike, IKEA and Levis etc.

2.2 Retailing in India

The current size of the Indian retail sector is 500 billion USD. This is expected to cross 1.3 trillion USD by 2020 (Muthukumar and Muthu, 2015). The Indian retail landscape is evolving from the brick-and-mortar model to adopt technology for connecting with consumers. Around 500 million people in India are below 25 years of age, resulting in a lot of demand for consumer products. India has since long been dominated by large Indian business houses. Groups like Future group, Aditya Birla group, Landmark etc., dominate the current retail landscape.

2.3 E-Retailing in India

Over the last two decades, rising internet and mobile phone penetration has changed the way we communicate and do business. Over the past few years, the e-retail sector in India has grown by almost 35% CAGR from 3.8 billion USD in 2009 to an estimated 12.6 billion USD in 2013. If this robust growth continues over the next few years, the size of the e-retail industry is poised to be 10 to 20 billion USD by 2017-2020, according to 'Internet and Mobile Association of India research report'.

3. Internet of Things

The Internet of Things (IoT) has brought every Object (things), consumer, and its activity into the digital world, which has become a driving force for innovation and new opportunities. Digitization of every employee, process, product and service are being performed by leading business. And retailers have also started experimenting with ways to use intelligent, connected devices to offer new services, reshape experiences and enter new markets by creating digital ecosystems. (Gregory, 2015)

3.1 Architecture

3.1.1 Three Layered Architecture

A three layered cloud-centric IoT architecture has first perception/sensing layer which collects the information from physical world. Next the information is sent to the network layer. Finally, data is used by the application layer. Cloud-centric IoT is composed of three layers as given below:

1. Application Layer
2. Network Layer
3. Perception Layer / Sensing Layer

The **Perception Layer** is based on EPC, RFID, sensors and other sensor technologies. Its main task is to identify the object and gather information. The **Network layer** is like neural network. Its main task is to transmit and process the information obtained from the perception layer through internet, communication network, radio network and other type of access network or private network. The **Application Layer** combines IoT social division and industries demand system or private network which are composed of terminal equipment such as, mobile phones, PCs, Input/output control equipment and database centers to provide the perception of information application services (Lopez et. al., 2012).

3.1.2 Five Layered Architecture

The autonomic-oriented system is mainly based on enforcement of self-managed decision making for smart devices (Verma D. C, 2002). This IoT architecture has ability to a support self-organized and self- manageable simple transfer protocol (STP) stack. This IoT architecture has:

1. Perception Layer/data layer,
2. Transportation Layer,
3. Network Layer,
4. Information Integration Layer, and
5. Business layer/management layer.

Perception layer consists of various sensing elements such as RFID technologies, 2D barcode, GPS, and other sensing technologies. The task of **transportation layer** is to transmit the information which is obtained from perception layer. Information transmission network can be WiMAX, WiFi, Bluetooth, Zigbee, mobile networks (such as, GSM, CDMA) and other communication equipment. The **information integration layer** mainly stores, manages and controls the massive data in the network in a real-time manner. SOA and cloud computing are the primary technologies used in this layer. The industry applications at this layer include intelligent transportation, identity authentication, safety, etc. **Business/Management Layer** is like the manager of all other layers in the IoT architecture. It manages the business applications such as the relevant business model and other businesses. It also manages user privacy which is important in the IoT.

3.1.3 Seven Layered Architecture

Published by Forbes, this seven layers of IoT reference architecture consists of the seven essential components for IoT:
Things, Edge Computing (or gateways), Cloud Infrastructure, Data Ingestion, Data Analytics, Applications and Decision Making based on apps and data.

3.2 Internet of Things in Retail Industry

Gregory (2015) in his report states, "The Internet of Things presents an opportunity for retailers to develop a vastly improved ecosystem that connects physical and digital worlds, allowing bidirectional, real-time interaction with consumers both inside and outside the store. The increasingly ubiquitous smartphone will be the hub for these interactions. One way is through location-based beacon technology; which retailers can use to interact directly with customers as they enter the store. Department store brands such as Lord & Taylor and Hudson's Bay are already using Apple's iBeacon technology and a mobile marketing platform called Swirl to deliver personalized promotions to customers who download the brand's app."
As a result, Retailers can leverage the copious amounts of data produced by these interactions to improve the customer's in-store experience. Using sensors to track customers' paths through a store, for example, can help managers improve store layout and merchandise placement strategies. Hugo Boss has already deployed heat sensors in its clothing stores to track customer movements, which helps managers place premium products in high-traffic areas.

4. Theory Development

Since Brick and Click Retailers are facing greater length of flexibility as compared to Brick and Mortar, they continuously use the strategy which leverages the technology at its optimal level. The Retailers have to carefully analyse the requirement of technology and it should match with their business orientation and the category in which they lie (Hypermarkets, Specialty Stores, Convenience Stores).
Following the same, this research mainly focuses on technology adaptation and their cost effectiveness for the different types of e- retail.

5. Hypothesis Development

The Degree of Formalization goes up in Brick and Click Model by introducing technology and it increases the flexibility to counter the uncertainty of market demand. In the brick and click model, operations are formalized and follow particular set of norms and rules, communication is formal and information sharing is limited and authentic

Adding IT to supply chain helps to convert supply chain into informative value chain. (Shere, 2005). Integration of Technology with existing physical resources helps to increase the flow of goods, reduce delivery time and help to

retain existing customers. (Herhausen et. al., 2015). Integration of ICT into supply chain helps in specialization of jobs which leads to more professional jobs and requires different skills' sets which have to be performed by professionals All the functioning is held under standard processing with a formal channel of communication. Big players try to inculcate standardized process in their structure to reduce ambiguity but due to changing demand and market needs, to increase the flexibility, procedure need to be modified with the product to fulfill the demand. By integrating the physical facility with internet technology which can share the information brings the synergy up as well as the flexibility goes up. (Steinfield et al, 2002)

H1 : Hypermarkets have greater variety in products with high level of uncertainty in the market. Hence required frequent reconfiguration of IoT systems. Thus, seven layers of IoT is required to cater these needs.

H2 : Specialty stores have dynamic relationship with both customer and suppliers; and for example, if limited (or at most) three specialty stores out of hundred can be pooled to use one IoT system to reduce cost. Hence required five layers of IoT.

H3 : Convenience stores have predictable customer base due to its convenience and they need to take care fo suppliers which requires simple or minimum IoT system, thus, ten or more Convenience stores out of hundred can be pooled to use one IoT system to reduce cost. Hence required three layers of IoT.

Different layers of IoT systems can be deployed for a pool of different retailers on same floor in a hypermarket , instead of implementing seven layers of IoT for whole hypermarket. It reduces the overall cost as by pooling, the retail formats lower level of IoT system can be leveraged and at the tie of failure of one IoT system, additional load can be transferred to another and can be used as a risk management strategy.

H4 : In a hypermarket, on the same floor there are many stores with similar strategy (i.e., convenience store or speciality store). Then a subset of all specialty stores on a given floor be assigned to an IoT with more number of layers, and similarly for convenience store on the same floor of given hypermarket. Also, it follows that much lower number of specialty stores be assigned to a given IoT compared to larger number of convenience stores that may be assigned to a given IoT.

This ensures lower cost and at the same time removes redundancies with a fault tolerant experience for all stores.

6. Conclusion

Technology adaptation and openness to technology are two different aspects and organizations need to analyse it with their s-curve (technology adoption curve). Big organizations mostly do mistakes in earlier adaptation of technology because of peer pressure in the market, but not able to leverage the maximum outcome of the particular technology. In case of large scale e-retailers (hypermarkets), they are encouraged to adopt and upgrade the new IoT technologies but keeping in mind of the long term strategies. Spending high budget in technology does not ensure the competitive edge. Sometimes, lower level of technology at right time of the market drivers will produce great results. In this research, we have seen like hypermarkets (big-budget stores) are spending high amount on technology adoption but they need to critically analyse and synchronise the technology with their organizational structure and strategy. Retailers need to classify their needs of IoT and small retailers need to pool themselves for technology adoption to reduce the overall cost and leverage the maximum potential of the particular IoT.

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