Technology Adoption for Different E-tailer Formats: A Conceptual Framework

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Abstract

The increasing trends in technological advancements have opened up a new horizon of opportunities for organizations. With the penetration of mobile technologies, the aspirant organizations have found a new medium to engage their stakeholders. Brick and mortar retailers often seem to invest high costs on technology and infrastructure, but the need of time emphasises to change the behavior of decision making. Various technology adoption models (TAM) have been deployed in past which help to adopt new technologies to sync with current systems. A new format called 'brick and click' retailers has flipped the traditional format of retail models and has opened up new possibilities for upcoming technologies. This study helps in identifying the upcoming Internet of Things (IoT) technology suitable for different formats of retailers, i.e., e-hypermarkets, e-specialty stores, and e-convenient stores. The model analyses assertive compatibility of IoT and Intranet of Things with the existing retail formats. For this study we have considered various e-tailer formats operating in Asian region specifically India, and empirical investigation is performed. The study proves significant at global level as the structure of e-tailers are seminal throughout the world.

Keywords

Brick and Click Retailers, Internet of Things, e-Retail Formats, and Technology adaptation.

1. Introduction

Recurrent technological upgrades have forced the established businesses to continuously re-consider their business models, while simultaneously offering feasible solutions and services to their end costumers. Retail industry is also not indifferent with this continuously changing technological landscape. Changing models of retail industry have come into effect since past decade, which has shown the industry as one of the major growing sectors worldwide. Various retail formats have emerged over time to cater the changing landscape of products and their demand amongst the existing and potential market.

Traditional retail format known as 'brick and mortar' model emerged to 'brick and click' model and now also moving towards a 'click and click' model. This study focuses on 'brick and click' model of e-retail formats. This model enables stakeholder to choose an appropriate method of buying and selling, by removing the constrictions of time and physical space. At present, one of the most trending areas in the innovation sector of Information Technology (IT) is Internet of Things (IoT). IoT was devised by Kevin Ashton from P&G. The ability of IoT to minimalize the human dependency and maximize the device interoperability has been researched and adapted by many organizations. Ashton (2009) refers to Internet of things as communication and sharing of information amongst real life objects through internet. This study helps in identifying the upcoming Internet of Things (IoT) technology suitable for different formats of e-retailers, i.e., e-hypermarkets, e-specialty stores, and e-convenient stores. The model analyses assertive compatibility of IoT and Intranet of Things with the existing retail formats. The study proposes theoretical model which helps to evaluate and adopt upcoming technologies (IoT, Intranet of Things, RFID, etc.), and comments on the adoption strategies for different e-tailers. For this study we have considered various e-tailer formats operating in Asian region specifically India, and empirical investigation is performed. The study proves significant at global level as the structure of e-tailers are seminal throughout the world.

2. Literature Review

2.1 Retailing

Significance of the retail industry can be measured by the fact that leading organization in the world is a retail chain, known as Wal-Mart. Of recent, retail sector has seen an exponential growth. Countries with strong hold on retail activities often march towards upper end of economic and social development. Kotler & Keller (2009) define Retailing as follows:

"*Retailing includes all the activities involved in selling goods or services to the final consumers for personal, non-business use. A retailer or retail store is any business enterprise whole sale volume comes primarily from retailing. Any organization selling to final consumers whether it is a manufacturer, wholesaler or retailer – is doing retailing. It does not matter how the goods or services are sold (by person, mail, telephone, vending machine or internet or where they are sold – in a store, on the street or in the consumer's home)*"

Retailers have now shifted their focus to the end customer and establishing personal contacts with them by trying to understand their preferences and buying behavior. (Kumar, 1996)

'**Brick and Mortar' Retail Format**

(a) Convenience Store – Convenience stores consist of a variety of products. Their kiosk varies from more than 800 sq. ft. to more than 4000 sq. ft. Most of the products provided at convenient stores are the daily use products. Refrigerated goods capture most of the sold good in these kind of stores (Kirby, 1986). Some of the examples of convenience stores are Family Mart, SPAR, 7-Eleven, etc.

(b) Hypermarkets – Hypermarkets provide a vast array of stock for the end-consumer to choose from. These are more of a self-service retail format. Hypermarkets are usually large in size and most of the time cover around more than 50,000 sq. ft. or more space in the outlet. Hypermarket business model focuses on high volume and low margin sales. Stock keeping Units (SKU) range from around 35, 000 to 60, 000. Majority (60-70%) of the sales of the products offered are that of Food items (Castrillo, Mira, & Gurdjian, 1998). Examples of hypermarket are Wal-Mart stores, Carrefour etc.

(c) Specialty Stores – Specialty stores deal with vast array of products for every category and predominantly cater to high-end customers, however, some of them also cater to the mass-consumer segment (Datamonitor, 2009). These stores are usually smaller in size depending upon the type and category of the product offered. Products are usually limited and highly specialized. Examples of specialty stores are Swarovski, Archie's, Toy's R, Nike, IKEA and Levis etc.

2.2 Retailing in India

Liberalization of Indian economy since 1990s sowed the seeds of changing consumer buying behavior in the country. Close to almost three decades now, retailer market in India has penetrated into all three tier cities. Functioning in an Indian retail market is not a linear task when compared to market dynamics of other economies (Sinha, Thomas, & Gokhale, 2012). "The size of Indian retail sector is expected to reach 1.3 trillion USD by

2020, much larger than current 500 billion USD size" (Muthukumar and Muthu, 2015). Retail landscape in India has evolved from the traditional 'brick and mortar' stores to adopt technology for connecting better with their end consumers. Retail in India has long been dominated by business giants like Future group, Aditya Birla group, Landmark etc., dominate the current retail landscape.

2.3 E-Retailing in India

With increasing use of tech-enabled consumers as well as producers, the retailers need to keep pace with the changing market scenario. Technology has penetrated not only the very base of consumers, but the way retailers connect with each other and do business. "The e-retail sector in India has grown, over last few years, by 35% from 3.8 billion USD in 2009 to an estimated 12.6 billion USD in 2013. Contemplating over this robust growth, the size of the e-retail industry is expected to reach 10 to 20 billion USD by 2017-2020", according to 'Internet and Mobile Association of India research report' (2015). Though, past researchers have identified technological compliance for 'brick and mortar' retailers but there is still not evident literature which connects the technological need for brick and click retailers. Also, there is no model available which could show that how segmented technological models can be used for different format of e-tailers. This study helps in identifying the upcoming Internet of Things (IoT) technology suitable for different formats of retailers, i.e., e-hypermarkets, e-specialty stores, and e-convenient stores.

3. Internet of Things

Every Object (things), end consumer, and their activity in the digital world has been brought together by the Internet of Things (IoT). IoT has become a compelling force for innovation and new opportunities in any sector. Every leading business is now administering the digitization of their employees, their business process, product information as well as services. Retailers are nowhere behind in ways to implement intelligent, connected devices for offering new array of services and reshape end-consumer experiences. This enables retailers to penetrate new markets by creating digital ecosystems (Gregory, 2015).

3.1 Architecture

The capability of IoT for communicating with billions or trillions of heterogenous objects through internet, requires for the need of flexible layered architecture of IoT. Various architectures have emerged since the beginning of the concept of IoT, from simplest to the complex ones devised by various researchers and industries. From the plethora of models devised, the basic is a Three-Layer architecture (Khan et al, 2012; Yang et al., 2011; Tan and Wang, 2010), whereas more advanced is that of a Five Layered Architecture. Some other architectures devised are – Middleware based architecture, and Service oriented architectures.

3.1.1 Three Layered Architecture

A three layered basic IoT architecture is composed of three layers as given below:

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

The Perception Layer of the three-layer architecture is based on sensors such as RFID as well as various other sensor technologies. The primary task of the perception layer is to identify the object and attain the information related to the object. Following Perception Layer is the Network layer, which is more like a neural network. Primary task of this layer is to communicate and process the information obtained from the perception layer. The information is obtained usually through internet, or a communication network, or radio network and many other types of access / private networks. The final application layer combines IoT social division and industries demand system or private network. These networks include terminus equipment such as, mobile-phones, personal computers, Input/output control systems and database centers to deliver the insight of information application services (Lopez et. al., 2012).

3.1.2. Five Layered Architecture

The five-layer architecture has evolved on the basis of lack if effective management and business methods from three-layer architecture. This architecture is developed by combining Transmission Control Protocol/Internet Protocol (TCP/IP), the Telecommunication Management Network (TMN), and the features of Internet of Things (IoT) (Verma D. C, 2002). The five-layer IoT architecture supports simple transfer protocol (STP) stack which

is self-organized and self-manageable. This IoT architecture has:

1. Perception Layer/data layer/Objects Layer,
2. Transmission Layer (Object Abstraction),
3. Network Layer (Service Management / Middleware Layer),
4. Information Integration Layer (Application Layer), and
5. Business layer/management layer.

Perception layer consists of sensing elements such as sensors, actuators, RFID technologies, 2D barcode, GPS, and other sensing technologies. The signals are passed to the transmission / transportation layer. The **transportation layer** transmits the data collected from perception layers to the network layer (or service management layer) These main communicating or information transferring networks can be classified as LAN, WAN, Wi-Fi, Bluetooth, mobile networks (such as, GSM, etc.) and similar other communication equipment. The **information integration layer** or the middleware layer is primarily a software layer between the transmission and application layer. Technology such as Service Oriented Architecture, cloud computing, etc. are used in this layer. The industry applications at this layer consist of intelligent transportation, identity authentication, safety, etc. **Business Layer** is the highest level which is in a way capable of managing the overall IoT architecture. This layer is capable of building business models on the basis of captured data from the application layer. It also manages user privacy by providing access to authorized users, which is one essential feature of IoT.

3.1.3. Seven Layered Architecture

Seven Layered Architecture published by Forbes 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 the report of IAMAI states that
"*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.*"

Retailers, as a result, have started to leverage the vast volumes of data produced by the machine interactions to enhance their end-consumer's in-store experience. One example for such a case can be using sensors for tracking consumer's movement through a store can help managers understand the ease of use or difficulty in navigating the store layout by the customer, ultimately taking decisions to enhance the store layout and merchandise placement strategies. One practical example is that of Hugo Boss, where they have implemented heat sensors in their clothing stores to capture their consumer's movement, through which managers can decide upon whether to place premium products in high-traffic areas.

4. Theory Development

Brick and Click Retailers enjoy more flexibility as compared to their traditional counterpart 'Brick and Mortar' retailers. E-Retailers constantly use the strategies which leverage the technological landscape at their optimal level. The need for the e-retail management is to carefully analyse the requirement of technology according to their own business orientation and category (Hypermarkets, Specialty Stores, Convenience Stores).
Following the argument, this research highlights the adaptation and cost-effectiveness of technology for different types of e-retailers.

5. Hypothesis Development

When 'Brick-and-Click' model introduces technology adoption, the degree of its formalization increases which also in-turn increases the degree of flexibility to secure the uncertainty in market demand. Brick and Click model of retail have formalized operations which follow the rules, and the mode of communication is formal with

limited and authentic information sharing.

Inclusion of IT application in the retail supply chain adds value to the supply chain by converting it into informative value chain (Shere, 2005). Technology adaptation with existing physical supplies upsurges the goods' flow, moderates the delivery time as well as helps to retain the consumer base (Herhausen et. al., 2015). Technology integration into the retail supply chain also helps in job specialization which creates the need of more professional jobs and requirement of varied skill sets which need to be performed by professionals. Formal channel of communication with standard processing is used for all kind of functioning. Standard processes are often inculcated by big players into their structure, in order to minimize ambiguity. However, ever changing market demand, leads for the need to increase flexibility, and the functional procedures need to be modified to fulfill the required product demand. Integrating physical resources with the technology, especially the interoperable technology, enables the synergy as well as the flexibility to scale up (Steinfield et al, 2002). Based on the arguments presented, this study proposes the following conjectures:

H1 : Hypermarkets being the complex structure among other categories and having vast array of products, have much higher level of market uncertainty. Therefore, such a category requires recurrent configuration of the IoT infrastructure. Hence, for the category of e-Hypermarkets, seven layers of IoT architecture is required.

H2 : Specialty stores most of the times have a dynamic and active interconnection with both their buyers and sellers. In such a case, the IoT infrastructure can be shared among one or more specialty store reducing the overall cost of the implementation. Hence, five layers of IoT architecture are required for e-Specialty stores.

H3 : Convenience stores require most of their attention towards their suppliers because of their expectable customers. This kind of structure needs minimalistic IoT infrastructure, hence more than a few stores can share one IoT system to reduce the overall cost. In such a scenario, e-Convenience stores need only three-layer of IoT infrastructure.

Various IoT layers can be integrated for a variety of different e-retailers on the same floor of Hypermarket, instead of going for more complex layers of IoT (seven-layers) for the whole infrastructure of hypermarket. Overall cost is reduced by pooling, and the lower level of IoT architecture could be leveraged. In case of any failure of one of the systems, superfluous load can be assigned to other system which acts as a risk management strategy. Hence, we arrive at our last conjecture as follows:

H4 : A typical Hypermarket often has many stores within the same floor capacity and on the same level there are many stores with alike strategic model (e.g., convenience or specialty). A complex IoT infrastructure can be assigned to a subset of alike store models or higher complexity. Similarly, a simple IoT architecture (say, three-layer) can be shared among another model of stores such as convenience stores. Therefore, a single e-hypermarket can cater to different level of IoT architecture for different store categories.

These strategies ensure the low cost and simultaneously enable the e-retailers to remove any redundancies with a fault tolerance experience for their stores.

6. Conclusion

The increasing trends in technological advancements have opened up a new horizon of opportunities for organizations. With the penetration of mobile technologies, the aspirant organizations have found a new medium to engage their stakeholders. Brick and mortar retailers often seem to invest high costs on technology and infrastructure, but the need of time emphasises to change the behavior of decision making. Often the two terms 'technology adoption' and the 'openness to technology' are used simultaneously in same context. However, these are two different aspects for the organizations, which need to be investigated with their s-curve (technology adoption curve). Dominant e-retailers (or for that matter, big organizations) most of the time do not consider carefully the strategies behind the earlier adoption of technology due to competitive pressure in the market, and hence are not able to leverage the maximum possible outcome of the adapted technology. Large scale e-retail formats, such as hypermarkets, are often encouraged to upgrade the latest IoT infrastructure, while keeping in view the long-term strategies needed. Competitive edge cannot be ensured by spending a high amount of budget on the technological infrastructure. Even the lower level of technology adaptation at the required needed time of the market demand will provide great results. Sometimes, lower level of technology at right time of the market

demand produces huge results. This research showcases that big-budget stores, such as hypermarkets, are often spending huge amount on technological infrastructure, however they also need to strategically analyze as well as synchronize the need for the infrastructure with their organizational strategies and structure. Large scale E-Retailers need to organize the needs of IoT architecture, whereas small retailers need to resource their organizations for the technology adaptation to minimize the overall cost and leverage the maximum prospective of the implemented IoT architecture.

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