

A study on the Approbation and Perception of Internet of Things (IoT) in Retail Hypermarket Outlets

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Abstract

Estimated to grow into a multi-trillion-dollar industry by 2025, IoT is the next big wave that will occur in any industry. This research is done to understand the future of IoT technology in the retail of Coimbatore. The study examines the awareness, perception and approbation of IoT technology among popular retailers of Coimbatore to explore the reach of IoT in organized Retail across Coimbatore, examine the scale of implementation that has been achieved in the retail industry of the region recognize the impact of IoT in Product and Process innovation and suggest areas of improvement. The research aims to study approbation, perception, concerns, IoT awareness and threats in terms of retail industry type and size, retail IoT sourcing, feedback on current implementation and willingness to invest in advanced IoT to identify the scale at which retailers of Coimbatore are prepared to latch on to the IoT wave that is already trending in all industries of the world.

Keywords: Internet of Things (IoT); organized retail; approbation; perception; product innovation; process

Innovation; Coimbatore.

1. Introduction

The term “Internet of Things” was coined in 1999 initially to promote RFID technology. From that point, IoT has come a long way to now become a fundamental component of every industry’s strategy (Groopman, 2015). IoT is defined as a combination of sensors and actuators embedded in physical objects linked through wired or wireless networks (Etlinger, 2015). Owing to the propensity and pertinence of data that can be obtained through this technology and its elevated the economy by creating new business opportunities and encouraging the digital businesses which resulted in employee efficiency and positive employer and customer engagement (Gartner research, 2017). IoT has many industrial applications in healthcare, manufacturing, logistics and has resulted in internet connectivity of everyday objects, making life simple for consumers. (Lima, 2015). This connectivity thus finds application in retail. Through IoT, the retail ecosystem is optimized and made proactive through its operational initiatives such as way-finding, consumer need mapping, tracking of their purchase pattern, tracking of

assets, virtual and personal interaction with customer by using the technology and highly efficient inventory management by using the sensor-enabled technology. The retail advantage lies in physical-digital converged experiences that are enriched with the help of digital media, mobile technology, sensor-enabled everyday products and social engagement that is predominantly online (International Data Corporation, 2016).

However, an engagement of this level brings many aspects like privacy and security threats into the picture which currently has a significant effect in the perception of consumers and businesses alike (Fertik, 2012). Despite the apparent setbacks of IoT, it is nevertheless the future of every industry, in this case, retail. This has led to considerable global investment into IoT technology. With IoT being in its nascent stage and the addressing of its security and with the addressable of its security and privacy concerns already underway, it is thus imperative for retail industries to incorporate IoT in their strategic initiatives.

The research aims to establish the extent of IoT awareness and resulting perception and approbation among the retailers of Coimbatore. This is achieved through a conceptual framework study of attributing product and process innovation through the benefits of IoT implementation experienced by retailers. The study of the benefits experienced by retailers is realized through the extent of awareness and perception of IoT. Senior management of 65 retail units across Coimbatore region were interviewed and their responses were studied to establish the overall reception of IoT among the retailers of the region.

The research report begins with a discussion on the literature reviewed with respect to the field of IoT and its current level of implementation in global retail with special reference to the Indian retail. This is followed by an elaboration on the objectives, research questions and methodology of the study. The reliability and validity of framework is also successively established and the data collection procedures that were implemented are shown. The framework is designed to signify the impact of currently prevailing product and process innovation in the retail of Coimbatore on the benefits experienced by establishing prior awareness and perception levels. The obtained results are statistically analyzed and represented through Structural Equation Modelling and Visual PLS to determine the more probable of the two arenas of product and process innovation in which future IoT development in Coimbatore will occur.

2. Review of Literature

2.1 Shift towards IoT

Due to its pervasiveness and myriad of applications, IoT has taken every industry in the world by storm. B2B applications enabled through IoT can create more value than pure consumer applications with a potential of improving economies in developing countries by 40%, the total economic impact amounting to \$11.1 trillion per year in 2025 (Manyika et al., 2015). Over 10 billion devices are connected giving access and medium for

large quantities of information exchange. This access facilitates the wider connectivity, mobile technology adoption, reduction in price of IoT devices which will be resulted in better understand of the customers (SyndiGate Media, 2017). With the next generation concept of industry 4.0 already underway, IoT plays the most major part in the new process of smart manufacturing (Clark, 2016). This undoubtedly places IoT as the harbinger of a technological upheaval in every industry.

2.2 IoT in Retail

IoT is also at the cusp of changing the functionality of the retail industry. The combination of machine to machine connectivity with Artificial intelligence turns data into something useful for the consumer and the business. American apparels use RFID tags to improve inventory management (Zhang, He & Xiao, 2013). Analysis of grey areas like stock level tracking and consumer data interpretation will be improved through IoT (Drinkwater, 2016). The retail showroom can provide very useful information about customer preferences, purchase pattern etc., besides, technologies like sensors, video footage in a demo area will help to track the visitors and their purchase behaviour of the potential buyers. Retail analytics will provide the broader picture of the situation (Clark, 2016). Ocado tested its automated warehouses and was successful in scanning 47000 items through IoT and Robotics (Murison, 2016). The retail industry is set to grow to \$4.4 trillion due to the combined need of integrating brick and click stores with online shopping experiences (Deloitte, 2016). In this technical driven era retailers can provide entertainment atmosphere to customers by combining the online and instore experience. (Drinkwater, 2017).

The Internet of Things is making people smarter, work easier and retail more agile. Disappearance of repetitive tasks through communicating devices reduces a team's workload. Customization/personalization of services has gained a natural and more personal touch. Anticipating customers' needs is easier with accurate predictions of stock-outs and supply chain issues (Wittenstein, 2017). Intelligent retail devices connected to cloud generate an unprecedented amount of data and customer insight. By applying technology solutions that capture, analyze and translate data into meaningful insights and optimal responses, retailers use business intelligence to anticipate and respond to shoppers' needs, whether online or in store. (Jensen, 2016). With these advancements in place, IoT in retail thus stands to be promising.

2.3 Indian Scenario

The IoT market in India is predicted to amount to USD 15 billion by 2020 to account for nearly 5 percent of the global market with investment over USD 1 billion pouring in from the government to support the development of over 100 smart cities (NASSCOM, 2016). IoT market in India is unstructured one with various players play different role of the industry value chain (Close-up media, 2015). Indian retail industry is fast growing industry to compare any other industry at a national level as well as global level.

Increasing number of mobile users, higher disposable income and consumer spending coupled with e-commerce penetration present tremendous opportunities for the retail industry (Mohapatra, 2017). Owing to the rising potential of IoT and an equivalent surge in the growth of Indian retail, IoT in the retail sector of India was considered for study. Though potential is present, IoT has not penetrated the retail segment in many parts of India.

2.4 Awareness

IoT is touted as the next big wave which will highly benefit both users and businesses, however, there are doubts regarding the levels of its awareness. In a survey conducted on 2000 US consumers, 64% did not purchase in-home IoT devices because they were unaware of IoT items like smoke detectors and smart-fridges were available for purchase (Accenture, 2014)

2.5 Perception

Detailed information about customer daily purchases, habits, preferences and their personalities behaviours are available in large quantity which are measured by various IoT devices which sensor based ones. Peppet and Scott (2014) listed the four inherent aspects of sensor-based technologies; the compounding effects of IoT devices called sensor fusion, the near impossibility of decoding sensor data, the likelihood that Internet of Things devices will be inherently prone to security flaws and the difficulty of meaningful consumer consent; which result in discrimination, privacy and security. In terms of perception, when a sample of 2062 US consumers was studied, 23% expressed concerns with price, 23% with privacy and 36% felt a lack of perceived value in IoT. In terms of gender: women were more likely than men to share data in exchange for coupons or discounts (Accenture, 2014).

In another sample of 2000 US respondents, 45% of respondents expressed low or no trust in companies assuring privacy over consumer data. However, consumers were most willing to share data for discounts and information on troubleshooting (Groopman et al., 2015). The expected threat of IoT devices that are designed without keeping security in mind poses concerns for retail organizations as well. But still risk related to IoT security having optimistic view because of technical challenges. These risks have been addressed through upcoming

technological advancements.

The hypothesis of the research is mentioned below. The hypothesis tests the influence of networking behavior with sales performance and the types of networking behavior with the types of sales performance.

H1: There is a positive influence between IoT implementation and product innovation.

H2: There is a positive influence between IoT implementation and process innovation.

3. Objectives of the Study

- a) To study and examine the awareness and perception of IoT among the organized retailers across Coimbatore region.
- b) To determine the benefits attained by organized retail outlets due to IoT implementation and the barriers involved in the IoT approbation.
- c) To examine the influence of IoT in product and process innovation in the organized retail outlets.

4. Research Questions

The research questions are formulated to assess the effect of IoT implantation challenges in the retail sector.

Research question 1: Are retailers of Coimbatore aware of Internet of things and its benefits? If yes, what is their perception about IoT?

Research question 2: Have organized retail outlets benefitted from IoT in any form? If not, what are the factors affecting their approbation?

Research question 3: Does IoT approbation in terms of IoT benefits significantly impact product and process innovation? If yes, which variable is influenced more?

5. Research Framework

The proposed research framework as shown in figure 1 graphs the relationship between IoT benefits in terms of customer experience, delivery process, safety, forecast accuracy, risk management and supply chain efficiency with that of product innovation in terms of new or existing product development and process innovation in terms of technological development, structured design and configuration management.

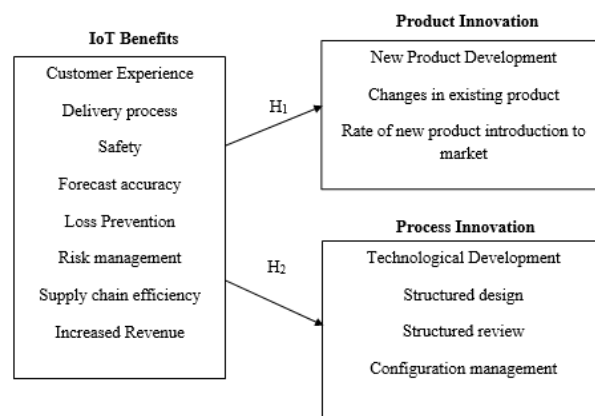


Fig. 1 Research Framework

6. Research Methodology

The present study helps decision makers ascertain the scope of IoT in retail in Coimbatore. The study is descriptive in nature, cross sectional and conducted over a period of three months, using primary data and causal in certain decision-making sessions. Organized retail in India is only 9%, constituting the population frame and the rest being the unorganized retail with 91%. Coimbatore city with a population of over 34 lakh as of 2011 was chosen as the sampling frame. Retail outlet owner, store managers, IT executives and HR persons of organized retailers of the Coimbatore region in Tamil Nadu are the samples of the present study. The sampling type used is the non-probability judgmental sampling; choosing different organized retail outlets across Coimbatore region.

7. Data Collection Procedure

The primary data was non-experimental comprising both qualitative and quantitative techniques. Data was collected through qualitative mode of personal direct interview with structured set of questions (Sinha and Banerjee, 2004; Malhotra, 2008). The data collected from 65 different organized retail stores across Coimbatore. Samples are collected randomly selected from the list of prominent organized retail outlets in the city. Only fifty-nine retail store executives responded and reacted to the questions in the interview. Out of this fifty-five samples are considered for the present study.

8. Measures

The instrument is developed and divided into five parts: the first part focused on the characteristics of respondents (Miller, 1983) including socio-economic, demographic, and geographic characteristics. The second part involved the respondent's awareness, perception and knowledge about IoT (Davis & Bagozzi, 1989). The third part included the Capability scale (Lie et al, 2005) and IoT alliance with other companies (Bang Nguyen, 2009). The fourth part focused on the contribution of IoT towards product innovation and process innovation as experienced by retail units in question (Du & Yong, 1999). The final part constituted the benefits (Kinnear, 1991) attained

through the approbation of IoT and the barriers (Ahlstrom, 1999) involved in implementing IoT in retail.

9. Validity and Reliability

The instruments are pre-tested by two stages with academicians and retail store managers. Cronbach's Alpha test is used to measure the internal consistency and reliability of the instrument. The reliability of the variables is: Reliability estimates for the construct variables are: capability scale (0.647), IoT alliance (0.883), process innovation (0.528), product innovation (0.894), benefits (0.865), barriers and perception (0.629) thus indicating a high degree of reliability of the variables. The variables are well accepted for the study because the test values are exceeded 0.50 which is the lower limit of the acceptability (Hair et al., 2003). Discriminant validity is also tested for the study. By using the confirmatory factor analysis convergent validity is also tested, which are reported more than the acceptance value (0.3) (Gerbing and Anderson, 1988).

10. Statistical Results and Analysis

The statistical results and analysis of the results can be divided into three stages – namely: respondents' profile, empirical results and structured equation modelling.

10.1 Respondents' profile

All respondents were adult males and females, comprising of either of the following roles in organized retail: store executives, managers, HR persons and owners. The list of respondents consisted of 8 females (6.66 percent) and 47 males (93.3 percent) with an average age of 32 years (range 23-40), modal age group 23-40 years and median age 35 years. Majority of the respondents (52.73 percent) had a Masters' degree as their educational qualification, 5.44 percent had only completed secondary education and the remaining 41.22 percent had completed till under-graduation as their respective educational qualifications.

The results of the respondent's demographic characteristics were summarized in the following table.

Table 1: Respondents' demographic characteristics

Variable	Description	Frequency	Percent	Mean	S.D
Gender	Male	47	93.3	-	-
	Female	8	6.66		
Age	18-22 years	0	0		
	23-40	37	74.1	32	8.56
	41-55	18	32.88		
	56 & above	0	0		
Education	Secondary Education	3	4.44	-	-
	Bachelor	23	41.22		
	Master	29	52.73		
	PhD	0	0		

Source: Primary data

The information on the respondents' awareness towards IoT among retail outlets less than a year old revealed that 84 percent know the basics of IoT while 16 percent of the respondents were not aware of IoT. It was also identified that 42 percent of the respondents have implemented IoT and the remaining 58 percent have not implemented IoT in their retail venture.

10.2 Empirical results

For testing research question 1, percentile analysis was done with 84% of the respondents showing awareness about IoT in which 67% of the 84 % of respondents responded with the right full form of IoT while the remaining 33% of the respondents were unsure about the nuances of IoT. The perception of IoT contributed significantly to the overall result of IoT approbation and the benefits of IoT in terms of product innovation and process innovation. The results depict all five parameters in the questionnaire related to perception showing a significant contribution to reliability in terms of Cronbach's Alpha value of 0.629.

Research question 2 examines the benefits that have been experienced by organized retail outlets due to IoT in various domains. IoT has played a significant role in improving customer experience, supply chain, cost efficiencies, loss prevention, risk management, improved forecast accuracy, increase revenues and improved delivery processes. The benefits have also been weighed against the equivalent barriers of IoT implementation in terms of integration challenges, unclear pricing, insufficient organizational awareness, lack of standardization, risk of migration and installation, implementation complexity,

privacy and security concerns, total cost concerns and inability to find suppliers. Bivariate Correlation is done between IoT benefits, product innovation, process innovation and the capability scale. The p values are significant between IoT benefits (Benm) and Product innovation (pdm) with significance value of 0.00 (2 – tailed). There also exists a significant correlation between IoT benefits (Benm) and Process innovation (psm) with a significant value of 0.017. Hence, it is inferred that IoT implementations have significant association with product and process innovation.

Research question 3 utilizes a Forward stepwise multiple linear regression approach was used to test the effect of product innovation and process innovation due to IoT implementation. The resulting regression models predicted 48.5 percent variation by product innovation and process innovation. The evolved regression models shown in the image yielded significant statistics (F=16.983, p=0.000). It is implicit that the assigned predictors of product innovation and process innovation accounted for significant variation in the dependent variable i.e. experienced IoT benefits.

10.3 Structured Equation Model (SEM)

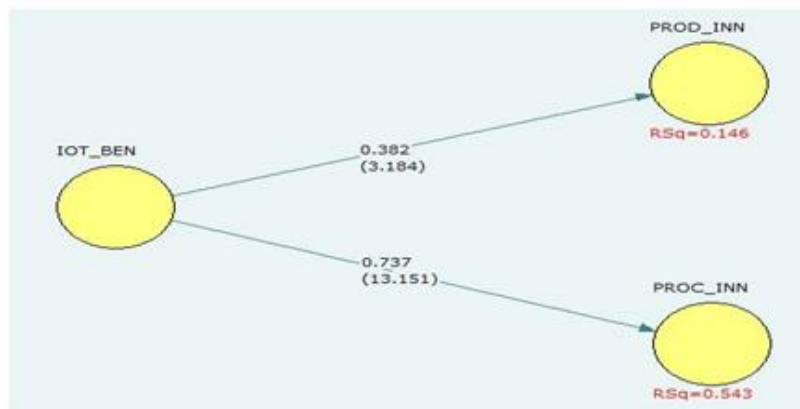
Forward stepwise bootstrap analysis is done and the structural model for the same is obtained using visual PLS. The model shows that IoT benefits play a significant role in Process innovation with a T value of 13.1512 (which is greater than the standard T value of 1.98); there has also been an impact on Product innovation with the T value of 3.1838 (which is also greater than the standard T value of 1.98).

Table 2: Bootstrap model- IoT implementation influencing Product, Process Innovation

Construct	Entire Sample Estim	T-statistics	Result
Product Innovation	0.3820	3.1838	Significant
Process Innovation	0.7370	13.1512	Significant

The Structured equation model as depicted below in figure 2 shows that R square value between IoT benefits and Process innovation is 0.543, thus implying a strong impact of IoT in process innovation over product innovation in which the R square value is only 0.146

Fig.2 Structural Equation Model between IoT Benefits and Process; Product innovation using Visual PLS



11. Discussion and Conclusion

The results of the study indicate that process innovation and product innovation are the highest-influenced variables in the designed framework for studying the approbation of IoT in Coimbatore region. This is inferred by strong t-values obtained for both variables, with the value for process innovation being higher, indicating stronger preference and potential in the area.

The designed questionnaire had high reliability and validity quotients and primary data collection techniques were employed using non-probability convenience sampling. The resulting demographic study of retailers interviewed for parameters of age, gender and educational qualification established that the majority of the respondents were male, aged between 23 and 40 and completed their Masters.

The Cronbach's Alpha test established the perception level of IoT in the region, based on obtained data, at 62.9%, indicating high degrees of perception. The bivariate correlation test also signified strong association between IoT benefits, product innovation and process innovation. 48.5% of the dependent variable of experienced IoT benefits is explained by product and process innovation variables through the regression test. Forward stepwise bootstrap analysis under structured equation modeling affirms the higher influence of process innovation over product innovation.

The superiority of IoT and its potential for growth holds great promise for businesses and consumers alike, with immense growth predicted for the retail industry, especially in India. The present research has established the extent of the implementation of IoT technology in Coimbatore region. Based on the objectives of determining awareness, perception and approbation, the framework of collecting product and process innovation of IoT in the region through realized IoT benefits was mapped. Obtained data from retailers was statistically analyzed to infer that process innovation holds higher promise for IoT in the retail of Coimbatore region. The research can be thus used to gauge the growth of IoT in the retail industry of Coimbatore. Further augmentation of this work can be done through incorporating more factors like preferences and culture in the current framework, increasing sample size of study or executing the same study over a broader region.

12. Research limitations and directions for further research

The study is the new attempt to understand the effect of Internet of Things on product innovation and process innovation in organized retail outlets. This study focused only on south Indian Manchester called Coimbatore. Further the study can observe specifically to other store formats in the same sector. This research limitation offers an opportunity for further research in two directions: one is the retail format- specific research like that of convenience store, discount stores and hypermarkets. Secondly, a comprehensive study for determining store format choice behavior in select retail formats can be done, taking various versions of the same as dependent variables. The current study is limited to

attributes like demographics and psychographics from the perception of retailer owners and not consumers. Further the study can be extended psychographic dimensions. The current IoT study in Indian retail can be made more comprehensive with inclusion of attributes of store formats, situational factors. The research can be also be executed by employing longitudinal research to facilitate unequivocal understanding of consumer behaviour in Indian retail. Finally, the same study can attempt in durables, luxury goods and fashion products

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