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Research Article

Exploring Consumers' Readiness And Acceptance Of Beacon Technology

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ABSTRACT

Purpose: The main objective of this study was to present a broader framework for evaluating beacon technology adoption and readiness. Prospects for beacons are promising, but given the high failure rate of new product innovation, it is important to assess customers' readiness and desire to adopt this technology.

Methodology: To assess beacon technology, this study integrated the technological readiness (TR) and acceptability (TAM) models. Five external factors and five internal variables were modified in this study. Perceived usefulness, perceived ease of use, intention to use, actual usage, and perceived enjoyment were the internal factors, and the five external variables were optimism, innovativeness, insecurity, discomfort, and perceived risk. A collection of data was done using questionnaire and AMOS -24 software was utilized to analyze the collected data on a sample of 534 respondents.

Findings: This study's noteworthy findings showed a favorable relationship between technological readiness and the perceptions of beacon technology's usefulness, convenience of use, and enjoyment. Furthermore, intention to use was positively related with beacon technology adoption, but perceived risk negatively related with beacon technology usage.

Practical Implications: This study filled a significant void in the field of proximity marketing and beacon technology. Retail managers may use the information in this study to help them plan their approaches to beacon technology and its ramifications. It could specifically direct them in handling risk-related concerns, developing beacon technology value propositions, and endorsing beacon technology as a pleasurable activity.

Originality: The study's conclusions provide South Asian merchants with insightful information that they can use to develop more successful retail strategies that will lead to the broad adoption of location-based retail apps.

Keywords: beacon technology, proximity marketing, technology acceptance model, technology readiness, perceived risk, perceived enjoyment, perceived usefulness

Introduction

Beacons are discrete hardware items that can warn cellphones or other devices anytime they approach them. Apple originally released beacons in 2013, and other location-based devices are starting to take notice of their low price and compact design. These tiny, location-based gadgets can provide information via radio signals that surrounding Bluetooth gadgets can pick up (Beeck & Toporowski, 2017). Beacons can help customers find their way through a business, track their activities, notify them to sales and coupons, crowdsource and increase in-store conversion rates, and more (Schrage et al., 2022). Global Market Insights, a consulting company, projects that the market for beacon technology would reach $25 billion by 2024 (Bhutani & Wadhwani, 2017). The global beacon market is expected to reach $14.7 billion in revenue by 2025 (VynZ Research, 2020) and $34.8 billion in revenue by 2027 (Maximize Market Research, 2022). This prediction differs from those made by a select few other marketing research companies.

The Asia-Pacific area is expected to see the fastest growth in beacon technology. From 2019 to 2026, it was predicted to grow at a CAGR of 79.6% for nations like India, China, and Japan.

The expansion of organized retail and the rise of cellphones in these nations are the causes of this growth (Agarwal et al. 2019, Roggeveen & Sethuraman, 2020). Despite the hopeful projections for beacons, it's still critical to gauge consumer interest in and adoption of them. New product innovation has an extremely high failure rate. This is due, in part, to producers starting up without first assessing the technology's readiness, which wastes time, causes revenue loss, and leaves customers unhappy (Clausing & Holmes, 2010, Venkatesh & Bala, 2008).The failure rate can be decreased with a thorough technological preparedness procedure. Any innovation's success or failure also hinges on how well users accept the technology. Both technology acceptability and readiness have been identified as high-risk issues. The failure of businesses to recognize the significance of these two aspects frequently results in large cost increases, project delays, scope cutbacks, and occasionally project cancellations (Kujawski, 2013).

Although studies on beacons, proximity-based apps, and location-based apps have been conducted in the past in Taiwan (Liu & Hsu, 2018), China (Liu et al., 2021), Germany (Schrage et al., 2022), America (Kang et al., 2015), and China, all of them attempted to study intention toward these studies by taking technology acceptance into account. Due to the major cultural variations, the results of these empirical investigations cannot be applied to South Asian clients. Additionally, none of these researches attempted to evaluate beacon technology readiness and adoption simultaneously. While various studies in South Asia (Agarwal & Singh, 2018; Ravi & Bhagat, 2020) undertook the study on usage of mobile app technology in retail settings and the ensuing retail experience, their main emphasis has been on examining the sales performance made possible by mobile app technology. However, the consumer behavior in these tests was treated constantly across all apps. It is noteworthy that customers react differently to different technologies, even if these technologies are used to provide the same services. Beacons have been extensively installed in Indian cities like Bangalore and Delhi. When talking about the use of beacons in India, it's important to note that retailers have largely been slow to accept them, and the adoption rate seems inconsistent. Nevertheless, this technology has a potential growth tendency.

Beacons can produce long-lasting and desirable benefits by integrating m-commerce and increasing the overall purchasing experience for customers. By proposing an enhanced model of technological readiness and acceptance among South Asian clients specifically for beacon technology, this study fills a gap in the body of knowledge. This study represents the first empirical study on South Asian purchasers. Retailers operating in South Asian nations can use the knowledge gained from this study to build more effective retail strategies that will promote the adoption of location-based retail applications.

Theoretical Framework and Hypothesis Development

Regarding the preparedness and adoption of technologies, earlier studies have provided a variety of hypotheses and models. This study is based on the popular TAM Model which stands for Technology Acceptance Model, propounded by Davis in 1989 and TRA Model which stands for Theory of Reasoned Action (TRA) by Ajzen and Fishbein (1980). These models were used for comprehending individual behavior with regard to the acceptance of in-store retail technology. The Technology Acceptance Model (TAM) comprises two fundamental components, namely the perceived ease of use and the perceived usefulness, which play pivotal roles in influencing the adoption behavior of Information Technology (IT) or Information Systems (IS). When it comes to explaining how individuals adopt technology in a professional setting, there has been criticism directed towards TAM 2 (developed by Venkatesh and Davis in 2000) and TAM 3 (introduced by Venkatesh and Bala in 2008), as highlighted by Schrage et al. in 2022 and Venkatesh et al. in 2012. Beacons can convey messages to customers, it is critical to gauge how good a purchasing experience is. As a result, the TAM 3 model's variable for perceived enjoyment was included in the current study (Venkatesh & Bala, 2008). Through their store's app on mobile devices, beacon technology provides the potential to engage customers in retail stores and collect accurate customer analytics. However, it is important to take data security and privacy hazards into account (Thamm et al., 2016), and this study discusses the dangers that come with beacons.

The Parasuraman (2000) notion of technology readiness is used to evaluate the preparedness of beacon technology. Technology readiness is the umbrella term for the four underlying aspects of optimism, innovativeness, discomfort, and insecurity that together impact a person's propensity to utilize novel technology. While optimism and innovativeness are favorable attitudes toward new technology, discomfort and insecurity are negative ones. For diverse technologies, these two models—technology readiness and acceptance—are merged and empirically tested (Larasati et al., 2017; Liu & Hsu, 2018).

Perceived risk, perceived delight, personal innovation, and relative advantage are additional variables that are introduced to the fundamental Technology Readiness and Acceptance Model (TRAM) (Liu and Hsu, 2018;

Schrage et al., 2022). Within the framework of beacon technology for library usage, perceived risk and satisfaction have especially been examined (Liu & Hsu, 2018).

As a continuation of the Technology Acceptance Model (TAM), as proposed by Davis et al. (1992) initially investigated perceived enjoyment, referring to it as the pleasurable and fun side of technology. According to earlier studies (Bouwman et al., 2014; Lai, 2018; Manis & Choi, 2019), perceived enjoyment increases perceived ease of use, usefulness, behavior intention, and usage in a positive way. A higher standard of picture technology was connected with higher felt enjoyment (Lee et al., 2006), and customers who were ready to pay more reported higher levels of enjoyment (Manis & Choi, 2019).

A belief in the likelihood of negative impacts or danger linked with anything is termed as perceived risk, another element explored in prior literature concerning TAM. Possible causes include anxiety, worry, discomfort, bewilderment, and cognitive dissonance with technology. Security risk, privacy issues, and financial risk are some common categories for perceived risk (Thakur & Srivastava, 2014). According to earlier studies, perceived risk affects how customers use technology, which negatively affects their attitude and intent to make a purchase (Galib et al., 2018).

These hypotheses are developed in light of the debate above. In Figure 1, the conceptual model is shown.

Ha1: Higher the technology readiness, higher will be the perceived enjoyment to use new innovative beacon equipments among customers.
Ha2: Higher the technology readiness, higher will be the perceived ease of use to use new innovative beacon equipments among customers.
Ha3: Higher the technology readiness, higher will be the perceived usefulness to use new innovative beacon equipments among customers.
Ha4: Higher the perceived risk, lower will be the intention to use new innovative beacon equipments among customers.
Ha5: Higher the perceived enjoyment, higher will be the intention to use new innovative beacon equipments among customers.
Ha6: Higher the perceived ease of use, higher will be the intention to use new innovative beacon equipments among customers.
Ha7: Higher the perceived usefulness, higher will be the intention to use new innovative beacon equipments among customers.
Ha8: A positive intention to use beacon equipments among customers lead to the actual use of new innovative beacon equipments among customers.

Research Model

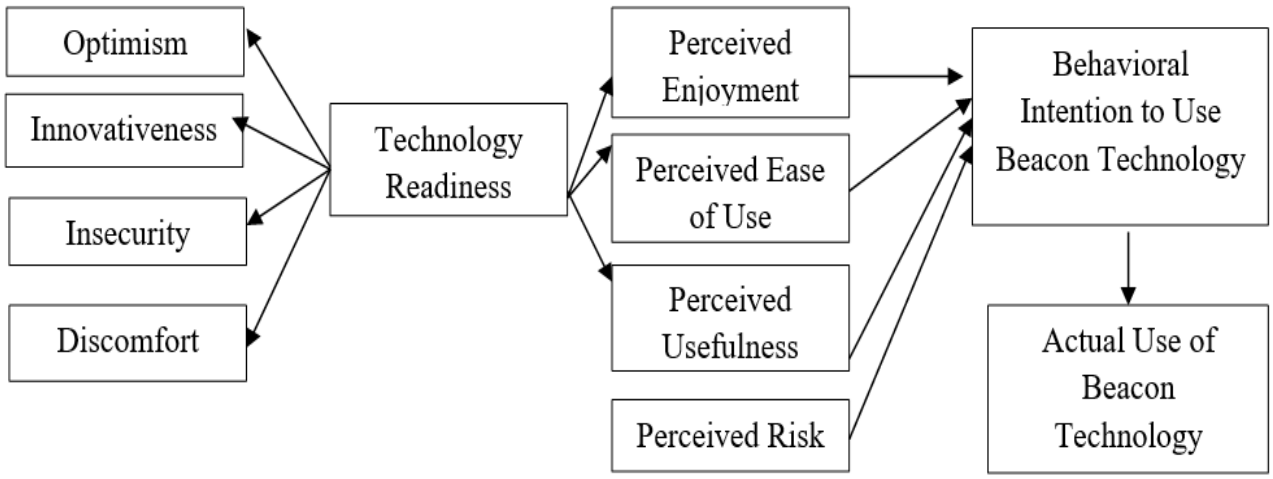

Figure 1: Proposed Research Work (Developed for this Research)

Methodology

Data Collection and Sample

This study is a descriptive in nature and uses deductive reasoning to examine the connections between numerous elements that affect how well-received and ready technology is. A special questionnaire was created to collect the data. The scale employed in this survey are detailed in Table 1.The variables used to gauge respondents' responses were drawn from prior research and assessed using a 5-point Likert scale.

Table 1: Instrumental Development

Variables used	No of items in questionnaire	Cronbach's Alpha of original Scale	Source
Optimism	4	0.80	Parasuraman & Colby (2015)
Innovativeness	4	0.83	Parasuraman & Colby (2015)
Insecurity	4	0.70	Parasuraman & Colby (2015)
Discomfort	4	0.71	Parasuraman & Colby (2015)
Perceived Ease of Use	5	0.92	Venkatesh & Davis (2000); Venkatesh & Bala(2008)
Perceived Usefulness	5	0.95	Venkatesh & Davis (2000); Venkatesh & Bala(2008)
Perceived Enjoyment	5	0.89	Venkatesh & Bala(2008)
Perceived Risk	5	0.78	Galib et al. (2018)
Intention to use	3	0.89	Venkatesh & Davis (2000); Venkatesh & Bala(2008)
Actual Usage	3	0.89	Venkatesh & Davis (2000); Venkatesh & Bala(2008)

A thorough description of beacon technology was given in the questionnaire to make sure that the respondents understood it. Along with the link to the survey, a video describing beacon technology was also provided to the responders. Before completing the survey, they were urged to watch the video and go over the instructions.
From December 2022 to May 2023, data for this study were gathered in Delhi, Mumbai, and Bangalore, three significant Indian cities. The target audience comprised those with smartphones and knowledge of beacon technology who were under the age of 65. These people either stated that they intended to employ beacon technology in the future or that they have used it in the past.

The population was treated as limitless due to the ongoing nature of the population formation process and the impossibility of recording all population elements. The study initially included 695 responders in total. The final study used 534 replies after missing or anomalous data were removed. 314 (58.8%) of the 534 responders were male, and 220 (41.2%) were female.

Data Preparation for Analysis

A thorough set of assessments were done on the entire dataset before starting the Structural Equation Modeling (SEM) analyses to make sure it adhered to the essential requirements for SEM, as defined by Morrison et al. (2017). These assessments included an assessment of collinearity, tests for homogeneity in both univariate as well as multivariate dimensions, and a measurement of autocorrelation.

Assessing the data's levels of skewness and kurtosis values was done to test for univariate normality. These metrics were used to confirm the existence of a normal univariate distribution, adhering to the traditional guidelines proposed by Pangriya and Rupesh Kumar (2018, which suggest values within the range of -2 to +2).
The evaluation was carried out using Mardia's metrics, which were initially laid out by Mardia (1970), for multivariate normality. Durbin-Watson statistics were computed as part of the autocorrelation examination. According to Chen (2016), the aforementioned test results are regarded as normal when they lie within an acceptable range of 1.5 to 2.5, while values outside of this range raising questions. The dataset's Durbin-Watson statistics all fell inside the permitted range, which is significant.

Reliability and Validity

Both the dimension of technological readiness and the dimension of technology acceptability underwent reliability and validity evaluations. Appendix A provides more information on the validity of the aspects showing technology readiness. In particular, it should be noted that the composite reliability values for optimism, inventiveness, insecurity, and discomfort have been estimated to have values of 0.741, 0.867, 0.763, and 0.798, respectively, thereby surpassing the conventional cutoff value of 0.7 (Peng & Lai, 2012). Cronbach's alpha coefficients likewise above the established cutoff for all sub-dimensions, with values for optimism, inventiveness, insecurity, and discomfort being 0.742, 0.869, 0.764, and 0.799 respectively. Most of the items showed standardized loadings that were higher than the required threshold. For the majority of dimensions, the AVE (average variance extracted) values were more than the minimum threshold (>0.5) (Hair et al., 2011). However, the AVE value was 0.497 in the case of discomfort, however this was acceptable because the composite reliability value was more than 0.60 (Pangriya & Rupesh Kumar, 2018). The results of similar evaluations conducted for the aspects of technological adoption are reported in Appendix B.

These findings suggest that each group's elements should all be tightly related to its corresponding sub-dimensions. In accordance with the findings of Fornell and Larcker (1981), if the square root of the Average Variance Extracted (AVE) exceeds the correlations between any two latent variables, it confirms discriminant validity, which is an essential aspect of these assessments.

For example, data in Table 2 showed that the square root of the Average Variance Extracted (AVE) for the optimism sub-dimension was 0.778. The AVE values for the variables employed in the study can be found in Table 2. These findings indicate that the latent variables exhibit discriminant validity and are statistically independent, with no issues related to multicollinearity.

Table 2: Discriminant validity of variables used in Research Model

Variables Used	AVE
Optimism	0.778
Innovativeness	0.776
Insecurity	0.723
Discomfort	0.702
Perceived Usefulness	0.788
Perceive Ease of Use	0.764
Perceived Enjoyment	0.758
Perceived Risk	0.759
Intention to Use	0.840
Actual Usage	0.770

Note: AVE Value extracted using gaskin Statistical tool (Developed for this Research)

Model Fit and Hypotheses Testing

Maximum likelihood estimation was used in structural equation modeling to test the hypotheses. Various incremental and goodness-of-fit indices were employed to assess the measurement model, encompassing absolute fit indices, incremental fit indices, and parsimony fit indices. The outcomes from all these indices collectively demonstrate a highly favorable model fit. The results specifically demonstrate that the model fit was within ranges that were considered to be acceptable (χ^2 /df =1.743< 5, RMSEA=0.076 < 0.100, AGFI= 0.902 > 0.800, CFI =0.907 > 0.900. The GFI, NFI and RFI values were all extremely close to the allowed range of > 0.900, at 0.907, 0.867, and 0.848 respectively. Although these numbers can be responsive to the sample size, with larger numbers of samples resulting in higher values, some researchers believe that values above 0.80 are acceptable.

It is important to note that some studies believe that values higher than 0.80 are appropriate, while acknowledging that these values can be sensitive to sample size, with bigger samples resulting in a somewhat worse fit (Forza & Filippini, 1998).

The hypothesis testing results, as presented in Table 3, provide support for all hypotheses from Ha1 to Ha8. Technology readiness was shown to support Ha1, Ha2, and Ha3 by significantly influencing perceptions of enjoyment, ease of use, and usefulness (β = 0.546, p = 0.000, β = 0.503, p = 0.000, and β=0.492, p = 0.000) respectively. Support was found for the hypothesis that technology use is negatively impacted by perceived risk.

Additionally, it was discovered that perceived enjoyment (β=0.764, p = 0.000), perceived ease of use (β = 0.724, p = 0.000), and perceived usefulness (β = 0.623, p = 0.000) all strongly affected the intention to use innovative beacon technology, supporting Ha5, Ha6, and Ha7. Last but not least, Ha8 was confirmed as intention to use (β = 0.759, p = 0.000) strongly affected the actual usage of beacon technology.

Discussion

The findings of the hypothesis testing show that all of the hypotheses, from Ha1 to Ha8, support the fundamental presuppositions of the researcher. According to the research, reported perceived enjoyment, perceived usefulness, and perceived ease of use of innovative beacon technology are all positively correlated with technological readiness. Although some discrepancies in the results are also reported (Oh et al., 2014; Roy et al., 2018), these findings are consistent with other studies carried out in a variety of technological situations (Bouwman et al., 2014; Elliott et al., 2013; Oh et al., 2014; Roy & Moorthi, 2017; Roy et al., 2018). This suggests that those who have a tendency toward technology will be more likely to utilize it if they perceive that beacon technology makes shopping hassle-free, saves them time, and gives convenience.

Furthermore, it is evident that perceived enjoyment, perceived usefulness, and intention to use all exhibit positive correlations with perceived ease of use. People seem to appreciate using beacon technology more when they find it simple to utilize. These people are also more inclined to adopt beacon technology and show confidence about its potential applications. There are studies that provide different findings (Ahmed et al., 2019; Bouwman et al., 2014; Oh et al., 2014), but these associations are consistent with the current study and are supported by prior research done in other situations (Kim & Chiu, 2019; Ritz et al., 2019; Tabeck & Singh, 2022).

The investigation also demonstrates an association between the intention to use beacon technology and the actual behavior of using it. This connection demonstrates that people are more likely to employ beacon technology when they have the ability to access it if they believe it will improve their productivity and shopping experience, such as by helping them find the greatest offers. These people are more likely to use beacon technology after reading favorable assessments from experts, and after doing so, they will probably tell other people about it. Although there are studies that demonstrate distinct links between these factors (Buyle et al., 2018; Galib et al., 2018), these findings are consistent with past research undertaken in other fields (Gautam et al., 2022; Kim & Chiu, 2019; Ritz et al., 2019).

The study also demonstrates that the intention to employ beacon technology affects its actual use, whereas perceived risk has a detrimental effect. Beacon technology adoption is hindered by perceived dangers of data loss, data abuse, privacy issues, and the aggravation of getting unsolicited messages. These findings align with prior research that has documented these correlations (Chakraborty, 2021; Sternad Zabukovek et al., 2019).

Managerial and Theoretical Implications

Beacon technology is positioned to change the face of retail as online and offline retail models merge and brick-and-mortar purchasing is seen as having more value. Managers should concentrate on spreading knowledge about beacon technology since the study shows that when people are told about it, they get interested in it. The simple and straightforward value proposition of beacons should be explained to new users, with an emphasis on their role in boosting daily shopping, usability, and lack of technological complexity. Awareness efforts using social media, in-store displays, or Wi-Fi can be successful for non-users. Additionally, professional and management endorsements have a significant impact on how beacon technology is actually used.

To market the technology, educational seminars should be held in physical store or via social media channels. Managers must also make ensure that the procedure of employing beacon technology is fun and educational. This is accomplished by giving consumers perceived value signals regarding continuing sales, offers, new product introductions, navigating the shop, and finding certain goods.

Customers should be encouraged by retailers to download beacon-compatible apps and to keep their mobile devices' Bluetooth connectivity and location settings on while they shop. Depending on the installation of the app and the length of Bluetooth connectivity inside the store, incentives including in-store prizes, vouchers, and exclusive deals may be made available. Practitioners can address worries about data loss and abuse while reassuring customers regarding the security of alerts regarding perceived usefulness, cost hazards, and privacy issues.

Customers need to be apprised of the unique codes that beacons send out that are accessible only by particular mobile applications by retailers. Additionally, since customers may choose not to clutter their smartphones with several store-specific applications, managers should think about creating one app that can be utilized at all of their locations.

Beyond its administrative implications, this study adds to existing domain of knowledge on beacon technology by offering fresh perspectives and examining connections that had not before been looked into, such reported enjoyment and its linkages to other factors. For academic academics and researchers, this research has great importance since it provides new opportunities for exploratory study of beacon technology.

Limitations of the Study and Scope for Future Research

In this study, the conventional Technology Acceptance Model (TAM) is employed, along with other variations like TAM2, TAM3, and the Unified Theory of Acceptance and Use of Technology (UTAUT), have their own drawbacks, particularly when it comes to determining direct correlations between variables. These alternate models may be taken into account in future study to perhaps reveal novel linkages and insightful new information. The precise time period and sampled cities could have a limiting effect on the study's reach. Future work may involve extending the study to include additional variables and interactions, fusing different acceptance of technology models with the technological Readiness model, and investigating mediation and moderation studies. It would be possible to look at demographic characteristics and cultural differences in connection to beacon technology adoption. There is also potential to investigate how offline data gathered by beacons may be combined with online buying behavior and vice versa, providing intriguing opportunities for further study in this are

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