# Consumers' Readiness and Acceptance of Beacon Technology

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## Abstract

**Purpose : The objective of this study was to present an extended technology readiness and acceptance model for beacon technology. Predictions for beacons are optimistic; despite this fact, it is important to measure customers' readiness and acceptance of this technology, as the failure rate of new product innovation is very high.**

**Methodology : This study merged the technology acceptance model (TAM) and the technology readiness (TR) model for beacon technology. A total of five exogenous variables influenced five endogenous variables in this study. The five exogenous variables are optimism, innovativeness, insecurity, discomfort, and perceived risk. The endogenous variables are perceived usefulness, perceived ease of use, intention to use, actual use, and perceived enjoyment. A questionnaire was used to collect the data, and analysis was performed with 404 samples on AMOS-26.**

**Findings : Significant findings of this study revealed that technology readiness led to perceived enjoyment, perceived ease of use, and perceived usefulness of using beacon equipment. Intention to use influenced the actual use of beacon technology, while perceived risk showed a negative influence on it.**

**Practical Implications : This study addressed an important gap in the field of beacon technology and proximity marketing. This report would help retail managers develop strategies for beacon technology and its implications. They could work on areas such as risk, generating value propositions through beacon technology, and projecting using beacon technology as a fun activity.**

**Originality : The findings of this study provide managerial insights for retailers operating in South Asian countries and would allow them to build more effective retail strategies to achieve widespread adoption of location-based retail applications.**

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

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Beacons are small hardware devices capable of sending alerts to smartphones or other devices whenever they come into their proximity. Beacons were first introduced by Apple in 2013, and their low cost and small size make them popular among other location-based devices. These micro, location-based devices can transmit information through radio signals, which can be received by nearby Bluetooth devices (Beeck & Toporowski, 2017). Beacons can be used to navigate customers inside the store, track their movements, send alerts on discounts and coupons to customers, crowdsource and advance in-store conversion rates, and so forth (Schrage et al., 2022). Consulting firm Global Market Insights predicts that the beacon technology market will surpass $25 billion by 2024 (Bhutani & Wadhwani, 2017). Few other marketing research organizations have predicted that the global beacon market will be $14.7 billion by 2025 (VynZ Research, 2020), and by the year 2027, it will touch $34.8 billion (Maximize Market Research, 2022).

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The North American region generates the majority of Bluetooth beacon's revenue since organized retailers predominate there. The forecast for the growth of beacon technology is highest for the Asia-Pacific region. It was projected to have a CAGR of 79.6% from 2019 – 2026 for countries like India, China, and Japan. The reason for this growth is the development of organized retail and the growth of smartphones in these countries (Agarwal et al., 2019; Roggeveen & Sethuraman, 2020).

Although the predictions for beacons are optimistic, despite this fact, it is important to measure customers' readiness and acceptance of them. The failure rate of new product innovation is very high. One of the reasons for this is that the producers go into production without evaluating the technology readiness, which results in a waste of time, loss of revenue, and dissatisfied customers (Clausing & Holmes, 2010; Venkatesh & Bala, 2008). An extensive technology readiness process can bring down the failure rate. Furthermore, the success or failure of any innovation depends on users' acceptance of the technology. Technology readiness and acceptance are both determined to be high-risk issues. Companies often fail to understand the importance of these two factors, which result in significant cost increases, delays in projects, scope reductions, and at times cancellations of commercial projects (Kujawski, 2013).

Beacon technology has the potential to engage customers in retail stores as well as they can understand customers precisely with the help of their store's app, which is present on customers' mobile devices. To make all of these possible, marketers need to consider data security and privacy risks as their prime responsibility (Beeck & Toporowski, 2017; Thamm et al., 2016). Apart from this, shopping enjoyment is another area marketers must consider (Schrage et al., 2022), as this technology sends forced messages to consumers. It might be possible that consumers don't like these push messages.

Although research on beacons, proximity-based apps, and location-based apps has been conducted in the past in America (Kang et al., 2015), China (Liu et al., 2021), Germany (Schrage et al., 2022), and Taiwan (Liu & Hsu, 2018), all of them took technology acceptance into account when trying to study intention toward these studies (Schrage et al., 2022). The findings of these empirical studies cannot be implemented for South Asian customers as the cultural differences are significant. Also, none of these studies tried to check technology readiness and acceptance together for beacons.

The present study is focused on the statements listed below:

- In the absence of a technology readiness assessment, unstable performance will disrupt later stages in the development process or, worse yet, appear once the product is in the hands of the customers (Clausing & Holmes, 2010).

- It is significant to note that user acceptance and confidence are crucial for the further development of any new technology (Taherdoost et al., 2013).

Few studies were performed in South Asia on the uses of mobile app technology in retail settings and the retail experience (Agarwal & Singh, 2018; Ravi & Bhagat, 2020), but their focus was on investigating sales performance through mobile app technology. These studies treated customer behavior homogeneously for different apps. However, it was seen that customers have varied responses toward different technologies, even when they are utilized to support the same service.

Beacons have been introduced on a trial basis in Indian cities like Bangalore, Delhi, and so forth. Talking about the implementation of beacons in India; very few retailers have adopted them, and the adoption rate is erratic. However, it can be predicted that this technology will grow in the future. This technology can provide long-term desired results and insights by integrating m-commerce and improving customers' shopping experiences. This study fills this gap that exists in the literature and presents an extended model of technology readiness and acceptance by South Asian customers for beacon technology. To our knowledge, this is the first empirical work

done on South Asian buyers. The findings of this study provide managerial insights for retailers operating in South Asian countries, allowing them to build more effective retail strategies to achieve widespread adoption of location-based retail applications.

## Theoretical Background and Hypothesis Development

Various theories and models were proposed in past studies for the acceptance and readiness of technologies. For technology acceptance, TAM is the popular model that was proposed by Davis (1989), which is based on the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980). TAM is the most accepted model to check individual behavior toward acceptance of in-store retail technology (Kaushik & Rahman, 2015; Kim et al., 2017). Davis introduced the notions of perceived ease of use and perceived usefulness as significant predictors of IT or IS adoption behavior. Further extensions were made to the TAM model. TAM 2 (Venkatesh & Davis, 2000) and TAM 3 (Venkatesh & Bala, 2008) are the extended technology readiness models that are criticized for explaining individuals technology acceptance at the workplace (Schrage et al., 2022; Venkatesh et al., 2012).

Since beacons are capable of sending push messages to customers on their mobile devices, they might be considered enjoyable during shopping or may not be, so measuring the fun content is essential. For this reason, perceived enjoyment is included as a variable in the present study, which was taken from the TAM 3 model (Venkatesh & Bala, 2008). Further, beacon technology could help marketers engage customers in retail stores and understand customers precisely with the help of their store's app, which is present on customers' mobile devices. To make all of these possible, marketers need to consider data security and privacy risks as their prime responsibility (Thamm et al., 2016). This study covers the risks associated with beacons.

For assessing the readiness of beacon technology, the technology readiness concept given by Parasuraman (2000) is used. Technology readiness outlines the mental impulse and hindrance that jointly regulate an individual's propensity to use innovative technologies. These feelings were defined as four sub-dimensions: optimism, inventiveness, discomfort, and insecurity. Optimism and innovativeness are decisive feelings, while discomfort and insecurity are adverse feelings of consumers toward new technology.

These two models (technology readiness and technology acceptance) are combined and empirically tested for various technologies (Larasati et al., 2017; Liu & Hsu, 2018). A few more variables were added to the basic TRAM. Perceived enjoyment, perceived risk (Liu & Hsu, 2018; Schrage et al., 2022), personal innovation, and relative advantage were discussed in previous literature (Liu & Hsu, 2018). Out of these, perceived enjoyment and perceived risk were discussed as beacons for library usage (Liu & Hsu, 2018).

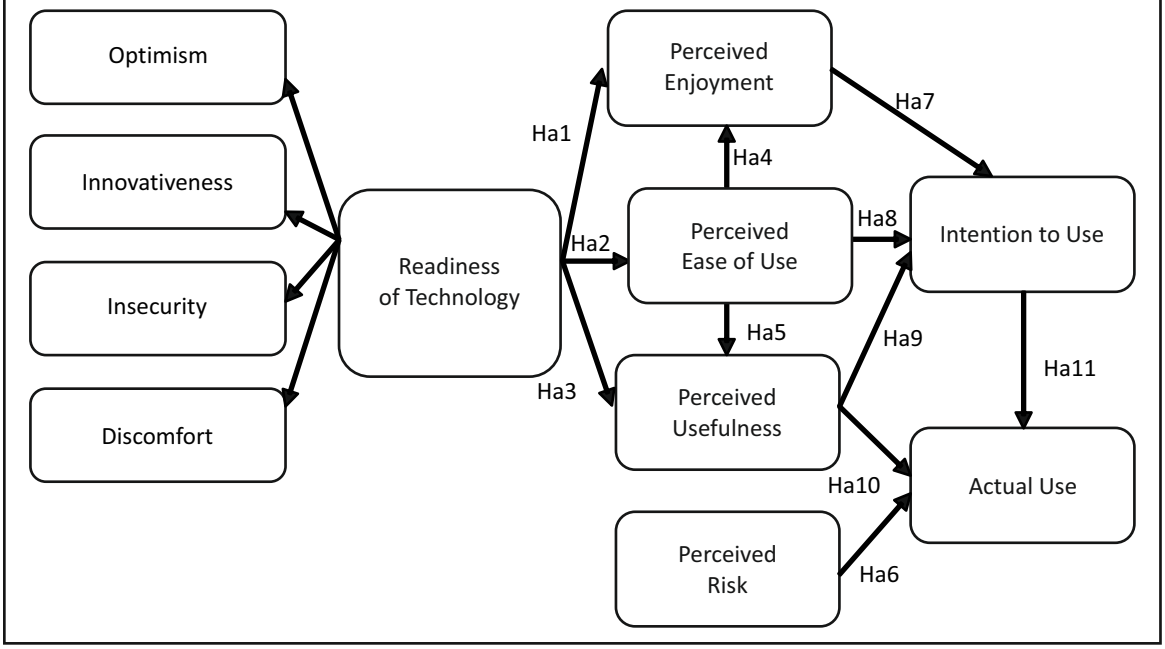
Davis et al. (1992) were the first to explore perceived enjoyment as an extension of the technology acceptance model. They characterized it as an appealing and fun level of technology. According to previous research, perceived enjoyment had a favorable effect on perceived ease of use, usefulness (Bouwman et al., 2014; Lai, 2018), and behavior intention and usage (Bouwman et al., 2014; Lai, 2018; Manis & Choi, 2019). Customers willing to pay more reported higher levels of enjoyment than those prepared to pay less (Manis & Choi, 2019). The perceived enjoyment of a higher standard of image technology was found to be higher (Lee et al., 2006).

Perceived risk is another factor that was discussed in previous literature with TAM. It is defined as a belief in the possibility of adverse effects or dangers associated with something. Anxiety, worry, discomfort, confusion, and cognitive dissonance with technology are found to have possible causes. Perceived risk is typically categorized into three classes: security risk, privacy concerns, and financial risk (Thakur & Srivastava, 2014). Customer technology use was influenced by perceived risk, which hindered purchasing intent and attitude (Galib et al., 2018).

Based on the above discussion, the following hypotheses are framed. Figure 1 represents the conceptual model.

↳ **Ha1 :** The readiness of technology leads to a higher perceived enjoyment of using beacon equipment.

**Figure 1.** ***Proposed Model for Technology Readiness and Acceptance for Beacon Technology***




- **Ha2 :** The readiness of technology leads to higher perceived ease of use of beacon equipment.
- **Ha3 :** The readiness of technology leads to higher perceived usefulness of beacon equipment.
- **Ha4 :** Perceived ease of use influences the perceived enjoyment of using beacon equipment.
- **Ha5 :** Perceived ease of use influences the perceived usefulness of using beacon equipment.
- **Ha6 :** Perceived risk toward technology negatively influences the actual use of beacon equipment.
- **Ha7 :** Perceived enjoyment of the technology influences the intention to use beacon equipment.
- **Ha8 :** Perceived ease of use of technology influences the intention to use beacon equipment.
- **Ha9 :** Perceived usefulness of technology influences the intention to use beacon equipment.
- **Ha10 :** Perceived usefulness of technology influences the actual use of beacon equipment.
- **Ha11 :** Intention leads to the actual use of beacon equipment.

## Methodology

### *Data Collection and Sample*

This study is classified as a descriptive study, and this investigation used a deductive method since it looked at the link between several aspects in the context of the technological acceptance and readiness models. A questionnaire was developed to collect the data. Table 1 presents the source of the scales used in the questionnaire. A 5 - point Likert scale was used to measure the constructs adopted from previous literature. A detailed explanation of beacon

**Table 1.** ***Scales Available for Measuring the Variables***

| Multi-Item Measure | Number of Items Used | Cronbach's Alpha Value of the 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) |
| Intention to Use | 3 | 0.89 | Venkatesh & Davis (2000) ; Venkatesh & Bala (2008) |
| Actual Usage | 3 | 0.89 | Venkatesh & Davis (2000) ; Venkatesh & Bala (2008) |
| Perceived Enjoyment | 5 | 0.89 | Venkatesh & Bala (2008) |
| Perceived Risk | 5 | 0.78 | Galib et al. (2018) |

technology was given to respondents in the questionnaire. A video on the beacon was also sent to the respondents, along with the questionnaire link. The respondents were asked to watch the video and read the instructions before filling out the questionnaire.

Data were collected from three cities in India: Delhi, Mumbai, and Bangalore, and the duration of this study was December 2021 – May 2022. Any individual up to the age of 65 who owned a smartphone and was aware of beacon technology was included in the target population (Moody, 2015). He or she should have used beacon technology or was willing to use it in the future. The population was endless and was generated by a continuous process for which no numbers were restricted. It was not possible to list all elements of the population (Anderson et al., 2017). So, the population was considered infinite (Anderson et al., 2000). A total of 635 respondents were recorded. After removing missing data and outliers, 404 responses were used for the final analysis. Out of the 404 respondents, 228 (56.4%) were men, and 176 (43.6%) were women. Data were analyzed using structural equation modeling (SEM), which was run on the AMOS.

## Analysis and Results

### *Data Preparation for Analysis*

Before SEM analysis, the entire data set was subjected to normality (univariate and multivariate), collinearity, and autocorrelation tests, which are the required assumptions of the SEM (Morrison et al., 2017). Univariate normality measures, skewness and kurtosis values between −2 and +2 are generally adequate for confirming a normal univariate distribution (Pangriya & Rupesh Kumar, 2018). For checking the multivariate normality, Mardia's measures (Mardia, 1970) of multivariate normality were checked, and the value for the overall model was 311.439. The Mardia coefficient cutoff is 1,848, with 42 observed variables (i.e., using the formula ($p$ ($p$ + 2)), where $p$ = 42. As this Mardia value was less than the coefficient cutoff (311.439 < 1,848), the combined distribution of the variables was multivariate normal (Bollen, 1989). Furthermore, all of the items had a variance inflation factor (VIF) of less than 5 and a tolerance value of less than 1 (Senaviratna & Cooray, 2019). Also, the condition index score was below the acceptable level of 30 (Senaviratna & Cooray, 2019), which indicates that multicollinearity is not a very serious concern. Durbin Watson's statistics were also calculated when it came to

autocorrelation. Test statistic levels in the range of 1.5 – 2.5 are considered normal; whereas, numbers outside this range may be cause for concern (Chen, 2016). All of the Durbin–Watson statistics were within acceptable limits.

### *Reliability and Validity*

Reliability and validity were checked for both technology readiness and acceptance dimensions. Reliability for reflecting dimensions of technology readiness is presented in Appendix A. It is clear that the composite reliability for optimism, innovativeness, insecurity, and discomfort is 0.843, 0.858, 0.812, and 0.796, respectively, and is above the accepted cutoff value of 0.7 (Peng & Lai, 2012). Another reliability measure, Cronbach's alpha for all sub-dimensions, is found above the accepted threshold. Cronbach's alpha for optimism is 0.844; for innovativeness, it is 0.859; for insecurity, 0.813; and for discomfort, 0.798. Also, most of the items have standardized loadings above the acceptance cut-off. The AVE values for most of the dimensions are above the acknowledgment necessity (> 0.5) (Hair et al., 2011). However, for discomfort, the AVE value is 0.497, which could be acknowledged as its composite reliability value is above 0.60 (Pangriya & Rupesh Kumar, 2018). Similar tests were performed for technology acceptance dimensions, and the results are presented in Appendix B. From the results, it's normal to expect that all of the objects in the group entirely converge to their sub-dimensions. The rule of thumb for discriminant validity is that the square root of AVE should be higher than inter-item correlations between any two latent variables (Fornell & Larcker, 1981).

From Table 2, for example, the square root of AVE of the innovativeness sub-dimension is 0.776, the intercorrelation between the innovativeness and optimism sub-dimension is 0.372, the intercorrelation between innovativeness and insecurity sub-dimension is −0.080, and the intercorrelation between innovativeness and discomfort sub-dimension is −0.025, all of which are less than the square root of AVE of the innovativeness sub-dimension. Similar tests were performed for technology acceptance dimensions, and the results are presented in

**Table 2.** ***Discriminant Validity for Technology Readiness Dimensions***

| | Optimism | Innovativeness | Insecurity | Discomfort |
|---|---|---|---|---|
| **Optimism** | **0.758*** | | | |
| **Innovativeness** | 0.372 | **0.776*** | | |
| **Insecurity** | 0.034 | –0.080 | **0.721*** | |
| **Discomfort** | 0.044 | –0.025 | 0.552 | **0.704*** |

***Note.****Square root of the original AVE values is shown in Table 2.

**Table 3.** ***Discriminant Validity for Dimensions Influencing Intention to Use and Actual Use of Technology***

| | Perceived Usefulness | Perceived Ease of Use | Perceived Enjoyment | Perceived Risk | Intention to Use | Actual Usage |
|---|---|---|---|---|---|---|
| **Perceived Usefulness** | **0.777*** | | | | | |
| **Perceived Ease of Use** | 0.678 | **0.754*** | – | – | – | |
| **Perceived Enjoyment** | 0.631 | 0.675 | **0.758*** | – | – | |
| **Perceived Risk** | –0.048 | –0.071 | –0.056 | **0.749*** | – | |
| **Intention to Use** | 0.655 | 0.710 | 0.749 | –0.046 | **0.830*** | |
| **Actual Usage** | 0.667 | 0.604 | 0.629 | –0.119 | 0.664 | **0.774*** |

***Note.****Square root of original AVE values is shown in Table 3.

Table 3. These values give discrimination validity among latent variables by not overlapping statistically and being free of the multi-linearity problem.

### *Model Fit and Hypotheses Testing*

Hypotheses testing is done through structural equation modeling using maximum likelihood estimation. Goodness-of-fit measures and incremental indices of the measurement model, that is, absolute fit indices, incremental fit indices, and parsimony fit indices, indicate a perfect model fit ($\chi^2/df = 2.747 < 5$, RMSEA = 0.066 < 0.100, AGFI = 0.802 > 0.800, CFI = 0.903 > 0.900, IFI = 0.904 > 0.900, PCFI = 0.789 > 0.500, PNFI = 0.737 > 0.500). The value of GFI is 0.897, NFI is 0.888, and RFI is 0.898, which is very close to the accepted value, that is > 0.900. Some researchers agreed that a value greater than 0.80 could be acceptable, as these values are sensitive to sample size, where the larger the sample, the lesser the fit (Forza & Filippini, 1998).

The hypothesis testing results in Table 4 indicate that all the hypotheses from Ha1 to Ha11 support the researcher's assumptions. Technology readiness has a significant positive influence on perceived enjoyment ($\beta = 0.594$, $p = 0.000$), perceived ease of use ($\beta = 0.471$, $p = 0.000$), and perceived usefulness ($\beta = 0.505$, $p = 0.000$), supporting Ha1, Ha2, and Ha3. Perceived ease of use has a positive impact on perceived enjoyment ($\beta = 0.672$, $p = 0.000$), and perceived usefulness ($\beta = 0.676$, $p = 0.000$) supports Ha4 and Ha5. Perceived risk has a negative impact on actual uses of technology ($\beta = -0.123$, $p = 0.035$), which supports Ha6. Intention to use beacon technology is found to be significantly influenced by perceived enjoyment ($\beta = 0.751$, $p = 0.000$), perceived ease of use ($\beta = 0.702$, $p = 0.000$), and perceived usefulness ($\beta = 0.645$, $p = 0.000$), which supports Ha7, Ha8, and Ha9. Perceived usefulness ($\beta = 0.666$, $p = 0.000$) and intention to use ($\beta = 0.669$, $p = 0.000$) have a significant influence on the actual use of beacon technology, which supports Ha10 and Ha11.

**Table 4.** ***Standardized Regression Weights for the Direct Association***

| Hypothesis | Hypothesized Path | Standard Estimate | SE | CR | *p* - value |
|---|---|---|---|---|---|
| Ha1 | *TR* → *PENJ* | 0.594 | 0.240 | 4.771 | 0.000* |
| Ha2 | *TR* → *PEU* | 0.471 | 0.206 | 4.112 | 0.000* |
| Ha3 | *TR* → *PU* | 0.505 | 0.230 | 4.392 | 0.000* |
| Ha4 | *PEU* → *PENJ* | 0.672 | 0.079 | 8.839 | 0.000* |
| Ha5 | *PEU* → *PU* | 0.676 | 0.073 | 9.607 | 0.000* |
| Ha6 | *PR* → *AU* | –0.123 | 0.059 | –2.11 | 0.035** |
| Ha7 | *PENJ* → *IU* | 0.751 | 0.079 | 11.102 | 0.000* |
| Ha8 | *PEU* → *IU* | 0.702 | 0.080 | 9.989 | 0.000* |
| Ha9 | *PU* → *IU* | 0.645 | 0.065 | 10.468 | 0.000* |
| Ha10 | *PU* → *AU* | 0.666 | 0.068 | 10.319 | 0.000* |
| Ha11 | *IU* → *AU* | 0.669 | 0.064 | 11.119 | 0.000* |

*Significant at 1% level, ** Significant at 5% level.

***Note.*** SE = Standard error, CR = Critical ratio, *TR* = Technology readiness, *PENJ* = Perceived enjoyment, *PEU* = Perceived ease of use, *PU* = Perceived usefulness, *PR* = Perceived risk, *IU* = Intention to use, *AU* = Actual use.

## Discussion

The hypothesis testing results indicate that all the hypotheses from Ha1 to Ha11 supported the researcher's assumptions. The results show that technology readiness leads to perceived enjoyment, perceived ease of use, and perceived usefulness of using beacon equipment. These findings corroborate the findings of previous research performed for other technologies (Bouwman et al., 2014; Elliott et al., 2013; Oh et al., 2014; Roy & Moorthi, 2017; Roy et al., 2018), while some discrepancy with the results is also noticed (Oh et al., 2014; Roy et al., 2018). In simpler words, a statement could be made that if a techno-savvy individual believes that the beacon technology provides a hassle-free shopping experience, saves shopping time, and is convenient, then he or she shows a willingness to use it and feels that the technology is easy to use and understandable (Moody, 2015). Apart from this, he/she also has fun using beacon technology.

Next, the relationship between perceived ease of use and perceived enjoyment, perceived usefulness, and intention to use is seen. Individuals who perceive that beacon technology is easy to use have more fun using it. Such individuals are optimistic about the beacon's usefulness and are more intent on using this technology. All these relations are supported by the current study, which shows consistency with past studies done for different settings (Kim & Chiu, 2019; Ritz et al., 2019; Tabeck & Singh, 2022), while some researchers (Ahmed et al., 2019; Bouwman et al., 2014; Oh et al., 2014) obtained results that were different from these results.

Results have shown that perceived usefulness has a strong relationship with the intention to use and actual use of the beacon technology. This relationship demonstrates that individuals who feel beacon technology is useful in shopping and improves shopping productivity by getting the best deals intend to use it more whenever they get access to this technology. Experts' strong reviews help to influence such individuals' decisions to use beacon technology. Once such users start using it, they also recommend it to others. These results display uniformity with the previous study results done for divergent areas (Gautam et al., 2022; Kim & Chiu, 2019; Ritz et al., 2019), although some studies have shown different connections between these variables (Buyle et al., 2018; Galib et al., 2018).

The outcomes of this study also support the subsequent association between reported satisfaction and intention to use. This confirmation proves that users who intend to use beacon technology perceive that this technology provides fun and extraordinary pleasure during shopping. This result is found to be valid in other past studies (Lai, 2018), while some disagreements were also there with this relation (Lee et al., 2006). Intention to use influences the actual use of beacon technology, while perceived risk has a negative influence on it. Risks related to loss of data, misuse of data, privacy issues, and the distress of sending unwanted perceived usefulness messages are some issues that stop an individual from using beacon technology. Previous studies also supported both of the relations discussed above (Chakraborty, 2021; Sternad Zabukovšek et al., 2019).

## Managerial and Theoretical Implications

As online and offline models are coming closer and brick-and-mortar models are gaining perceived usefulness, beacons will be the game-changer in future retail. Managers need to create awareness of beacon technology, as respondents showed interest in this technology after being made aware of it. Marketers should educate first-time users on the value proposition in a clear and precise manner. They should apprise users that a beacon could help in their daily shopping, can be conveniently used, and has no technical complications. For non-users, these kinds of awareness campaigns can be run by using social media, in-store posters, or a Wi-Fi connection. The actual use of beacon technology is influenced by the strong opinions of experts and managers, and educational sessions must be conducted with them. These sessions could be done in-store or on social media platforms. Also, managers need to make the actual process of using beacon technology pleasant and fun-filled. It could be achieved by informing

customers through perceived usefulness messages about ongoing discounts, offers, information on new launches, in-store navigation, and locating specific products.

Retailers need to incentivize customers to upload an app that supports technology and keep mobile Bluetooth and location settings open during shopping. It could be achieved through in-store rewards, gift cards, and offers. Those benefits could be availed of after the uploading of the app on mobile and the duration of Bluetooth connectivity in the store. Practitioners need to work on data misuse and data loss. Also, it is a must to assure consumers of perceived usefulness notifications, financial risks, and privacy risks. Customers have good reason to be concerned since they may place a greater value on their mobile device than the benefits they obtain from a retail app. Retailers need to educate customers that beacons send unique codes that can only be read by certain mobile applications. Also, managers need to think about a single app for all stores. A customer can't download all the shop's apps on his/her mobile device.

Apart from managerial implications, this study will add to the existing literature on beacon technology and show a different dimension of beacon research. In this study, a few variables and relations were discussed for the first time for beacon technology, such as perceived enjoyment and its relation to other variables. This article will be extremely useful for academic scholars and researchers and will present an exploratory dimension of research in the area of beacon technology.

## Limitations of the Study and Scope for Future Research

The technology acceptance model has various forms like TAM, TAM2, TAM3, UTAUT, and so forth, but this study goes with the basic TAM model. The TAM2, TAM3, and UTAUT models have limitations in terms of measuring the direct relationship between variables. These models did not examine the direct relationship between the variables, which could reveal some new relationships and important findings from the study (Lai, 2017). The time duration and sample cities covered for this study could be another limitation of this study. Future work could be further extended, including studying more variables and relations. In this research, we combined TAM and TR models, although other models of technology acceptance could be combined with TR. In the present study, I have also studied the direct relationship between the variables. The scope of mediation and moderation analysis is possible with a similar kind of study. Also, the moderation of demographic factors could be discussed in certain relationships. A similar kind of study could be performed with different demographics or cross-cultural studies could be performed. Further work could be extended in the direction where the effect of offline data collected by beacons could be integrated with online shopping behavior or vice versa.

## Author's Contribution

The author, Ruchita Pangriya, affirms that she is solely responsible for the following: study conceptualization and design, data collection, data analysis and interpretation, and manuscript preparation.

## Conflict of Interest

The author certifies that she has no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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## References


Agarwal, A., & Singh, M. R. (2018). The relationship between retail experience, customer satisfaction, and behavioral intention: Exploring the consumer shopping behavior in unorganized retail settings. *Indian Journal of Marketing*, *48*(1), 9–27. https://doi.org/10.17010/ijom/2018/v48/i1/120733

Agarwal, V., Sahoo, R., & Agarwal, A. (2019). A study on factors affecting mobile phone buying behavior in Bhubaneswar and Cuttack. *Indian Journal of Marketing*, *49*(11), 20–38. https://doi.org/10.17010/ijom/2019/v49/i11/148274

Ahmed, F., Qin, Y. J., & Martínez, L. (2019). Sustainable change management through employee readiness: Decision support system adoption in technology-intensive British e-businesses. *Sustainability, 11*(11), 2998. https://doi.org/10.3390/su11112998

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Prentice Hall.

Anderson, D. R., Sweeney, D. J., & Williams, T. A. (2000). *Essentials of statistics for business and economics*. South-Western College.

Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D., & Cochran, J. J. (2017). *Essentials of statistics for business & economics.* Cengage Learning.

Beeck, I., & Toporowski, W. (2017). When location and content matter: Effects of mobile messages on intention to redeem. *International Journal of Retail & Distribution Management*, *45*(7/8), 826–843. https://doi.org/10.1108/IJRDM-09-2016-0171

Bhutani, A., & Wadhwani, P. (2017, December). *Beacon technology market report 2024 – Global industry forecast.* Global Market Insights. https://www.gminsights.com/industry-analysis/beacon-technology-market

Bollen, K. A. (1989). *Structural equations with latent variables*. John Wiley & Sons. https://doi.org/10.1002/9781118619179

Bouwman, M. E., Kommers, P. A., & van Deursen, A. J. (2014). Revising TAM for hedonic location-based social networks: The influence of TAM, perceived enjoyment, innovativeness and extraversion. *International Journal of Web Based Communities*, *10*(2), 188–210. https://doi.org/10.1504/IJWBC.2014.060355

Buyle, R., Van Compernolle, M., Vlassenroot, E., Vanlishout, Z., Mechant, P., & Mannens, E. (2018). "Technology readiness and acceptance model" as a predictor for the use intention of data standards in smart cities. *Media and Communication*, *6*(4), 127–139. https://doi.org/10.17645/mac.v6i4.1679

Chakraborty, D. (2021). Factors influencing passengers' purchase intention towards app-cab services in metro cities of India: A study on smartphone users. *Indian Journal of Marketing*, *51*(1), 41–54. https://doi.org/10.17010/10.17010/ijom/2021/v51/i1/156933

Chen, Y. (2016). Spatial autocorrelation approaches to testing residuals from least squares regression. *PLoS ONE*, *11*(1), e0146865. https://doi.org/10.1371/journal.pone.0146865

Clausing, D., & Holmes, M. (2010). Technology readiness. *Research-Technology Management*, *53*(4), 52–59. https://doi.org/10.1080/08956308.2010.11657640

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, *22*(14), 1111–1132. https://doi.org/10.1111/j.1559-1816.1992.tb00945.x

Elliott, K. M., Hall, M. C., & Meng, J. (2013). Consumers' intention to use self-scanning technology: The role of technology readiness and perceptions toward self-service technology. *Academy of Marketing Studies Journal*, *17*(1), 129–143.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Forza, C., & Filippini, R. (1998). TQM impact on quality conformance and customer satisfaction: A causal model. *International Journal of Production Economics*, *55*(1), 1–20. https://doi.org/10.1016/S0925-5273(98)00007-3

Galib, M. H., Hammou, K. A., & Steiger, J. (2018). Predicting consumer behavior: An extension of technology acceptance model. *International Journal of Marketing Studies*, *10*(3), 73–90. https://doi.org/10.5539/ijms.v10n3p73

Gautam, S., Malik, P., & Jain, S. (2022). Role of trusting beliefs and trust in the adoption of online reviews of hotels: Extension of the IAM model. *Indian Journal of Marketing*, *52*(11), 8–25. https://doi.org/10.17010/ijom/2022/v52/i11/172431

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202

Kang, J.-Y., Mun, J. M., & Johnson, K. K. (2015). In-store mobile usage: Downloading and usage intention toward mobile location-based retail apps. *Computers in Human Behavior*, *46*, 210–217. https://doi.org/10.1016/j.chb.2015.01.012

Kaushik, A. K., & Rahman, Z. (2015). An alternative model of self-service retail technology adoption. *Journal of Services Marketing*, *29*(5), 406–420. https://doi.org/10.1108/JSM-08-2014-0276

Kim, H.-Y., Lee, J. Y., Mun, J. M., & Johnson, K. K. (2017). Consumer adoption of smart in-store technology: Assessing the predictive value of attitude versus beliefs in the technology acceptance model. *International Journal of Fashion Design, Technology and Education*, *10*(1), 26–36. https://doi.org/10.1080/17543266.2016.1177737

Kim, T., & Chiu, W. (2019). Consumer acceptance of sports wearable technology: The role of technology readiness. *International Journal of Sports Marketing and Sponsorship*, *20*(1), 109–126. https://doi.org/10.1108/IJSMS-06-2017-0050

Kujawski, E. (2013). Analysis and critique of the system readiness level. In, *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, *43*(4), 979–987. https://doi.org/10.1109/TSMCA.2012.2209868

Lai, P. C. (2017). Security as an extension to TAM model: Consumers' intention to use a single platform e-payment. *Asia-Pacific Journal of Management Research and Innovation*, *13*(3–4), 110–119. https://doi.org/10.1177/2319510X18776405

Lai, P. C. (2018). Single platform e-payment system consumers' intention to use. *Journal of Information Technology Management*, *29*(2), 22–28. https://jitm.ubalt.edu/XXIX-2/article2.pdf

Larasati, N., Widyawan, & Santosa, P. I. (2017). Technology readiness and technology acceptance model in new technology implementation process in low technology SMEs. *International Journal of Innovation, Management and Technology*, *8*(2), 113–117. https://doi.org/10.18178/ijimt.2017.8.2.713

Lee, H.-H., Fiore, A. M., & Kim, J. (2006). The role of the technology acceptance model in explaining effects of image interactivity technology on consumer responses. *International Journal of Retail & Distribution Management*, *34*(8), 621–644. https://doi.org/10.1108/09590550610675949

Liu, D.-Y., & Hsu, K.-S. (2018). A study on user behavior analysis of integrate beacon technology into library information services. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(5), 1987–1997. https://doi.org/10.29333/ejmste/85865

Liu, W., Guo, W., & Zhu, X. (2021). Map-aided indoor positioning algorithm with complex deployed BLE beacons. *ISPRS International Journal of Geo-Information*, *10*(8), 526. https://doi.org/10.3390/ijgi10080526

Manis, K. T., & Choi, D. (2019). The virtual reality hardware acceptance model (VR-HAM): Extending and individuating the technology acceptance model (TAM) for virtual reality hardware. *Journal of Business Research*, *100*, 503–513. https://doi.org/10.1016/j.jbusres.2018.10.021

Mardia, K. V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika*, *57*(3), 519–530. https://doi.org/10.2307/2334770

Maximize Market Research. (2022). *Digital forensics market – Global industry analysis and forecast (2023 – 2029)*. https://www.maximizemarketresearch.com/market-report/global-digital-forensics-market/3163/

Moody, M. (2015). Analysis of promising Beacon technology for consumers. *Elon Journal of Undergraduate Research in Communications*, *6*(1), 3–11.

Morrison, T. G., Morrison, M. A., & McCutcheon, J. M. (2017). Best practice recommendations for using structural equation modelling in psychological research. *Psychology*, *8*(9), 1326–1341. https://doi.org/10.4236/psych.2017.89086

Oh, J. C., Yoon, S. J., & Chung, N. (2014). The role of technology readiness in consumers' adoption of mobile internet services between South Korea and China. *International Journal of Mobile Communications*, *12*(3), 229–248. https://doi.org/10.1504/IJMC.2014.061460

Pangriya, R., & Rupesh Kumar, M. (2018). A study of consumers' attitude towards online private label brands using the tri-component model. *Indian Journal of Marketing*, *48*(5), 7–20. https://doi.org/10.17010/ijom/2018/v48/i5/123440

Parasuraman, A. (2000). Technology readiness index (TRI): A multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research*, *2*(4), 307–320. https://doi.org/10.1177/109467050024001

Parasuraman, A., & Colby, C. L. (2015). An updated and streamlined technology readiness index: TRI 2.0. *Journal of Service Research*, *18*(1), 59–74. https://doi.org/10.1177/1094670514539730

Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management*, *30*(6), 467–480. https://doi.org/10.1016/j.jom.2012.06.002

Ravi, S. S., & Bhagat, S. (2020). Will mobile application technology help retail merchandising? Breakthrough innovation by FMCG companies. *Indian Journal of Marketing*, *50*(12), 24–39. https://doi.org/10.17010/ijom/2020/v50/i12/156307

Ritz, W., Wolf, M., & McQuitty, S. (2019). Digital marketing adoption and success for small businesses: The application of the do-it-yourself and technology acceptance models. *Journal of Research in Interactive Marketing*, *13*(2), 179–203. https://doi.org/10.1108/JRIM-04-2018-0062

Roggeveen, A. L., & Sethuraman, R. (2020). Customer-interfacing retail technologies in 2020 & beyond: An integrative framework and research directions. *Journal of Retailing*, *96*(3), 299–309. https://doi.org/10.1016/j.jretai.2020.08.001

Roy, S. K., Balaji, M. S., Quazi, A., & Quaddus, M. (2018). Predictors of customer acceptance of and resistance to smart technologies in the retail sector. *Journal of Retailing and Consumer Services*, *42*, 147–160. https://doi.org/10.1016/j.jretconser.2018.02.005

Roy, S., & Moorthi, Y. L. (2017). Technology readiness, perceived ubiquity and M-commerce adoption: The moderating role of privacy. *Journal of Research in Interactive Marketing*, *11*(3), 268–295. https://doi.org/10.1108/JRIM-01-2016-0005

Schrage, R., Meißner, L., Schütte, R., & Kenning, P. (2022). Acceptance of in-store apps: Factors that influence the intention to adopt location-based retail apps – Insights from Germany. *International Journal of Retail & Distribution Management, 50*(6), 760–777. https://doi.org/10.1108/IJRDM-06-2020-0202

Senaviratna, N. A., & Cooray, T. M. (2019). Diagnosing multicollinearity of logistic regression model. *Asian Journal of Probability and Statistics*, *5*(2), 1–9. https://doi.org/10.9734/ajpas/2019/v5i230132

Sternad Zabukovšek, S., Picek, R., Bobek, S., Šišovska Klančnik, I., & Tominc, P. (2019). Technology acceptance model based study of students' attitudes toward use of enterprise resource planning solutions. *Journal of Information and Organizational Sciences*, *43*(1), 49–71. https://doi.org/10.31341/jios.43.1.4

Tabeck, P. S., & Singh, A. B. (2022). Acceptance of mobile apps among bottom of pyramid customers of urban areas. *Indian Journal of Marketing*, *52*(9), 43–58. https://doi.org/10.17010/ijom/2022/v52/i9/171984

Taherdoost, H., Sahibuddin, S., & Jalaliyoon, N. (2013). E-services usage evaluation; applications' level of co-creation and digitalization. *International Journal of Academic Research in Management (IJARM)*, *2*(1), 10–18.

Thakur, R., & Srivastava, M. (2014). Adoption readiness, personal innovativeness, perceived risk and usage intention across customer groups for mobile payment services in India. *Internet Research*, *24*(3), 369–392. https://doi.org/10.1108/IntR-12-2012-0244

Thamm, A., Anke, J., Haugk, S., & Radic, D. (2016). Towards the omni-channel: Beacon-based services in retail. In W. Abramowicz, R. Alt, & B. Franczyk (eds.), *Business information systems. BIS 2016. Lecture notes in business information processing* (Vol. 255, pp. 181–192). Springer. https://doi.org/10.1007/978-3-319-39426-8_15

Venkatesh, V., & Bala, H. (2008). Technology acceptance Model 3 and a research agenda on interventions. *Decision Sciences*, *39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, *36*(1), 157–178. https://doi.org/10.2307/41410412

VynZ Research. (2020). *Global Beacon technology market was valued at USD 1.9 billion and is expected to reach USD 16.8 billion by 2030, observing a CAGR of 38.0% during 2022–2030*. https://www.vynzresearch.com/press-release/global-beacon-technology-market

# Appendix

**Appendix A :** ***Reliability and Item Loadings for the Technology Readiness Dimension***

| Latent Variable | Indicators | Standardized Loadings (β) | Composite Reliability | Cronbach's Alpha | AVE |
|---|---|---|---|---|---|
| Optimism | *OPTI_1* | 0.804 | 0.843 | 0.844 | 0.575 |
| | *OPTI_2* | 0.787 | | | |
| | *OPTI_3* | 0.704 | | | |
| | *OPTI_4* | 0.733 | | | |
| Innovativeness | *INOV_1* | 0.712 | 0.858 | 0.859 | 0.603 |
| | *INOV_2* | 0.826 | | | |
| | *INOV_3* | 0.847 | | | |
| | *INOV_4* | 0.712 | | | |
| Insecurity | *INSE_1* | 0.712 | 0.812 | 0.813 | 0.520 |
| | *INSE_2* | 0.773 | | | |
| | *INSE_3* | 0.697 | | | |
| | *INSE_4* | 0.700 | | | |
| Discomfort | *DISC_1* | 0.641 | 0.796 | 0.798 | 0.497 |
| | *DISC_2* | 0.819 | | | |
| | *DISC_3* | 0.623 | | | |
| | *DISC_4* | 0.721 | | | |

**Appendix B :** ***Reliability and Item Loadings of Dimensions Influencing Intention to Use and Actual Use of Technology***

| Latent Variable | Indicators | Standardized Loadings (β) | Composite Reliability | Cronbach's Alpha | AVE |
|---|---|---|---|---|---|
| Perceived Usefulness | *P_USE_1* | 0.733 | 0.884 | 0.885 | 0.605 |
| | *P_USE_2* | 0.822 | | | |
| | *P_USE_3* | 0.774 | | | |
| | *P_USE_4* | 0.839 | | | |
| | *P_USE_5* | 0.714 | | | |
| Perceived Ease of Use | *P_EASE_1* | 0.675 | 0.867 | 0.868 | 0.569 |
| | *P_EASE_2* | 0.853 | | | |
| | *P_EASE_3* | 0.806 | | | |
| | *P_EASE_4* | 0.784 | | | |
| | *P_EASE_5* | 0.631 | | | |
| Intention to Use | *INT_USE_1* | 0.864 | 0.870 | 0.870 | 0.690 |
| | *INT_USE_2* | 0.821 | | | |
| | *INT_USE_3* | 0.806 | | | |
| Actual Use of Technology | *ACT_USE_1* | 0.800 | 0.816 | 0.818 | 0.600 |
| | *ACT_USE_2* | 0.668 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | *ACT_USE_3* | 0.844 | | | |
| Perceived Enjoyment | *P_ENJOY_1* | 0.836 | 0.868 | 0.870 | 0.575 |
| | *P_ENJOY_2* | 0.865 | | | |
| | *P_ENJOY_3* | 0.850 | | | |
| | *P_ENJOY_4* | 0.577 | | | |
| | *P_ENJOY_5* | 0.610 | | | |
| Perceived Risk | *PER_RISK_1* | 0.690 | 0.865 | 0.865 | 0.562 |
| | *PER_RISK_2* | 0.704 | | | |
| | *PER_RISK_3* | 0.776 | | | |
| | *PER_RISK_4* | 0.842 | | | |
| | *PER_RISK_5* | 0.727 | | | |

## Appendix C. *Variable Statements for the Variables Included in Appendix A and Appendix B*

| Items | Statement |
|---|---|
| *OPTI_1* | Beacon technology gives me more control over my daily shopping. |
| *OPTI_2* | Retail stores that use beacon technologies are much more convenient for shopping. |
| *OPTI_3* | I prefer to use the most advanced technology available. |
| *OPTI_4* | I feel confident that machines will follow through with what you instruct them to do. |
| *INOV_1* | Other people come to you for advice on new retail technologies. |
| *INOV_2* | I can usually figure out new high-tech products and services without help from others. |
| *INOV_3* | I enjoy the challenge of figuring out high-tech retail technologies. |
| *INOV_4* | I am always open to learning about new and different technologies. |
| *INSE_1* | Technically supported shopping is not helpful because it does not explain things in terms I understand. |
| *INSE_2* | I think retail technology systems are not designed for ordinary people. |
| *INSE_3* | It is embarrassing to have trouble with a high-tech gadget while people watch. |
| *INSE_4* | New technology makes it too easy for companies to spy on people. |
| *DISC_1* | The human touch is very important when shopping in a retail store. |
| *DISC_2* | Too much use of retail technology distracts people to a point that is harmful. |
| *DISC_3* | Whenever something gets automated, we must carefully check that the system is not making mistakes. |
| *DISC_4* | It can be risky to switch to a revolutionary new technology too quickly. |
| *P_USE_1* | I find beacon technology useful in shopping. |
| *P_USE_2* | I expect beacon technology to improve my shopping productivity. |
| *P_USE_3* | I feel this technology is helpful in getting the best deals. |
| *P_USE_4* | I expect beacon technology to reduce my shopping time. |
| *P_USE_5* | I expect beacon technology to enhance my shopping experience. |
| *P_EASE_1* | Interacting with the mobile during shopping does not require much mental effort. |
| *P_EASE_2* | I think this technology is easy to use. |
| *P_EASE_3* | My interaction with this technology will be clear and understandable. |
| *P_EASE_4* | I feel using this technology is clear and understandable. |
| *P_EASE_5* | I feel using this technology will allow me to shop how I want. |

| | |
|---|---|
| *INT_USE_1* | Assuming I have access to the technology, I intend to use it. |
| *INT_USE_2* | Given that I can access the technology, I predict I will use it. |
| *INT_USE_3* | In the future, I will use beacon technology in shopping. |
| *ACT_USE_1* | Given that I have access to beacon technology, which is most useful, I would definitely use it. |
| *ACT_USE_2* | My decision on the actual usage of beacon technology will be based on a strong review by the experts on other users. |
| *ACT_USE_3* | I would recommend to my friends and relatives to use beacon technology based on my own experience. |
| *P_ENJOY_1* | I expect using this technology to be enjoyable. |
| *P_ENJOY_2* | I feel that the actual process of using this technology will be pleasant. |
| *P_ENJOY_3* | I expect to have fun using this technology. |
| *P_ENJOY_4* | Shopping by using beacon technology will make me feel like I am in another world. |
| *P_ENJOY_5* | I expect using this technology to be appealing. |
| *PER_RISK_1* | I worry that my personal information collected could be misused. |
| *PER_RISK_2* | I fear that the device's battery will run out while using beacon technology, or the connection will otherwise be lost. |
| *PER_RISK_3* | I think using beacon technology increases the likelihood of receiving spam messages. |
| *PER_RISK_4* | I fear retailers will send advertisements without the user's consent. |
| *PER_RISK_5* | I think beacon service providers could provide my personal information to other companies without my consent. |

## About the Author

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