

Article

Gamification as An Approach to Promote Tourist Recycling Behavior

Lidia Aguiar-Castillo ^{1,*}, Alberto Clavijo-Rodriguez ², Petra De Saa-Perez ¹ and Rafael Perez-Jimenez ¹

¹ IDeTIC, Universidad de Las Palmas de Gran Canaria, 35001 Las Palmas de Gran Canaria, Spain; petra.desaaperez@idetic.eu (P.D.S.-P.); rperez@idetic.eu (R.P.-J.)

² Fundacion Parque Cientifico Tecnologico, PCT Tafira, Edif. Poliv. III, 35017 Las Palmas de Gran Canaria, Spain; alberto.clavijo@fpct.ulpgc.es

* Correspondence: laguiar@idetic.eu; Tel.: +34-928-45-9972

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Abstract: Recycling behavior is an issue that affects the sustainability of many seasonal destinations. The EU promotes projects such as the UrbanWaste that try to study how to avoid the deplorable consequences on cities of this situation. This project has implemented a gamified application, named WasteApp in several European cities, in order to promote the recycling behavior of tourists. This study aimed to verify if the application can be a successful tool to foster recycling and to improve tourism destination reputation. The results show that tourist satisfaction will be influenced directly by the perceived usefulness of the application, and perceived usefulness by the perceived ease of use, but the expectations of the prizes can be counterproductive if they are not perceived as useful for the promoted behavior. Likewise, the satisfaction of the user will influence the recycling behavior, which at the same time improves the reputation of the destination. Besides, the initiative will be visible through word of mouth that is generated from the perceived usefulness, the user's satisfaction, and the recycling behavior itself. That is, according to this study a gamified application can contribute to the recycling behavior of tourists and improve the image of the destination that adopts it.

Keywords: gamification; recycling behavior; tourism destination reputation

1. Introduction

Europe was the continent with the highest number of international tourists in 2017, flourishing 8.4% over the previous year. This growing number of visitors has been favored by different factors such as the increase of low-cost airlines that lead to the consequent rise in connectivity, as well as the economic growth in countries with a significant potential outbound tourism market [1]. Moreover, traveling evolves through new concepts, as the shared economy and social media produce systemic changes in the way of understanding relationships between the environment and tourists. Besides, many tourists use digital technologies and are more receptive to the recommendations of other travelers, relatives and friends. They also demand sustainable tourism products and services as well as personalized experiences. Along with all this, the reduction of purchasing power has made people consider sharing resources with the consequent increase in the collaborative economy [2].

The negative perception of the resident in destinations with overcrowded tourism is manifested with worries of a different nature among which are the fear of the loss of identity, increase of prices and rise in infrastructure dedicated to tourism to the detriment of those for residents. Besides, there are concerns about a lack of affordable housing due to the growth of collaborative platforms, and the congestion derived from one-day travelers, such as cruise tourism's impact on the environment. Furthermore, although tourism generates wealth, it also has adverse effects on the local economy

by increasing inflation and offering a type of work, in general, that is not highly qualified. On the other hand, and although it is sometimes a sign of prosperity, at other times it causes impoverishment induced by the unequal distribution of the benefits and the non-recognition of the academic degree of the workers [3].

Some destinations are already taking measures to control overcrowding. Dubrovnik and Santorini are limiting the access of cruise passengers. Amsterdam and Venice use technology to avoid congestion in real time, informing tourists about the agglomeration that is occurring in certain places, and giving information about less saturated alternative visits. According to experts, prices can be another measure to balance demand and supply. A method proposed includes segmentation of rates by type of visitors or according to the time of day. Some destinations even set an amount to guarantee its sustainability. For example, in Paris, the Eiffel Tower has announced that it will carry out an improvement of its facilities, which will be partially covered by an increase in the price of tickets. Also, the Pantheon of Rome, one of the best-preserved monuments of the ancient world that attracts seven million visitors each year, recognizes a need for maintenance. For this reason, it has started to charge entrance for the first time, and this money will be used for the conservation of the monument. Among the problems that overloaded tourist destination municipalities have encountered is the integration of visitors into the recycling ecosystem [4].

The concern to keep humanity under scales of adequate sustainability makes the idea of promoting pro-environmental behaviors as a relevant channel to achieve that goal. The mobility of the tourist is posing a pressing problem in those cities with a floating population markedly superior to its permanent population. This fact generates issues of different types in cities, one of them, the lack of information about bins and recycling areas that can have significant effects on the image of the destination. Individuals appear to be well aware of the need to recycle and will generally do so if they know how to do. Recycling is well accepted by citizens as an activity that is worth undertaking, so long as the means to do it exist [5].

This work was framed in the field of sustainable tourism through recycling behaviors, as a part of H2020 research initiative performed by a consortium of 11 cities (Nicosia, Syracuse, Santander, Ponta Delgada, Lisbon, Tenerife, Dubrovnik, Nice, Copenhagen, Kavala, and Florence), named UrbanWaste [6]. One of the research proposals consisted of the development of a gamified application based on geolocation to foster tourist recycling behavior through a series of awards. This section of the project was divided into three main phases. First, the application was defined and refined with feedback from a technical focus group. After that, a set of four selected pilot cities was used to verify the intent to use the application from a group of potential users [7]. These results were used to re-define the app before implementing the final version that was tested with tourists who participated in a field experiment carried out in the pilot cities selected.

This paper aims to elucidate if this type of initiative promotes good environmental behavior of tourists and whether it affects the image of the destination. Concretely, the research proposal consists of the study of attitudes from tourists after using a gamified application. This paper takes a step to study not only the gamified application features that influence users' satisfaction through their perceptions, but also the effect that this users' satisfaction exerts on their pro-environmental habits, and finally the influence of this concrete recycling behavior on the image of the tourist destination where the tool is used. Additionally, it studies the effect of the awards over users' behavior and WoM (Word of Mouth), i.e., the intention to recommend the application (Figure 1).

The work is structured as follows: the next section describes materials and methods used by the application. Tourist recycling behavior and its relationship with gamification are studied in Section 3. Hypotheses are developed in Section 4, proposing the relations between user satisfaction and recycling behavior and describing the awards and the use of WoM on the final impact. Section 5 studies the research methods, while Section 6 deals with the results obtained. Finally, the results are discussed, and some conclusions are extracted.

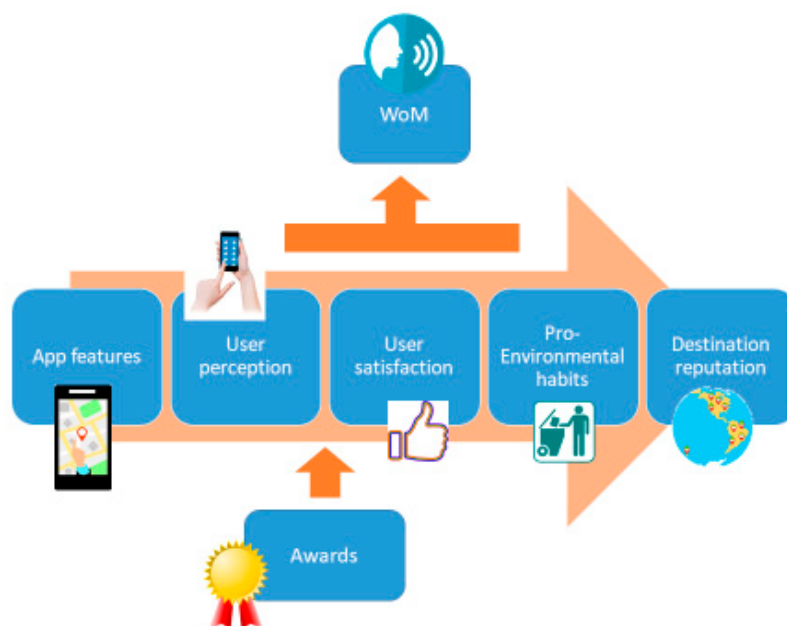


Figure 1. Experimentation model.

2. Material and Methods

This section explains how the design of the application was carried out and which design factors were studied in previous research [7].

2.1. WasteApp

As previously stated, WasteApp is an application for mobile devices, which is part of the UrbanWaste H2020 project [6]. It is aimed at tourists in whom a triple objective is pursued. On the one hand, it is intended to make tourists aware of the right use of infrastructures for the selective collection of waste; on the other hand, it is a question of using the application as a platform for an extensive gathering of data for further analysis concerning the tourists' waste separation behavior. Additionally, this application provides tourist information and collects complaints from users. Finally, it seeks to inform the user about policies and ways of recycling in each city, indicating waste collection points, collection times, and other data of interest to the tourist. The application follows a paradigm based on gamification to achieve the mentioned objectives. The proposed gamification relies on obtaining points that can be exchanged for prizes in the pilot cities of the UrbanWaste consortium. The mechanisms of securing points are the reading of QR (Quick Response) codes located in the waste bins of the towns and the posting of comments on social networks using the project hashtag. These trash cans appear on a map provided by the application. Furthermore, each city has an offer of awards that tourists can exchange for the corresponding points.

There is a recent approach that proposes a design of gamified applications focused on the heterogeneous preferences of users [8]. However, in the WasteApp design, a generic approach was chosen because each city has different target tourism to which the application is directed. Despite this approach, it has tended to center the application towards socializer tourists that focus on communicating their actions [9].

Privacy has been guaranteed since no personal data has been requested to avoid problems and compliance with European and national standards on data protection. Additionally, access has been provided through login and password identification, too, with salt coding to improve security. Finally, the username and password are deleted to elude possible difficulties about the data.

2.2. Design of the Application

The gamified application has been developed using the MDA (mechanics, dynamics, aesthetics) paradigm [10,11]. The design was stratified into layers. First, a mechanics layer dealt with the algorithmic relationships and data structures. Second, a dynamic layer was in charge of the user's utilization of mechanics and the interactions of the internal structures of the game itself. Finally, a "sensations" layer was directly related with the final objective of the game: to evoke an emotional response from the user. In this case, the target is directly connected to three primary mechanisms: the implicit reward of knowing that contributes to the sustainability of the place visited, obtaining points and, finally, the tangible reward received (see Figure 2).

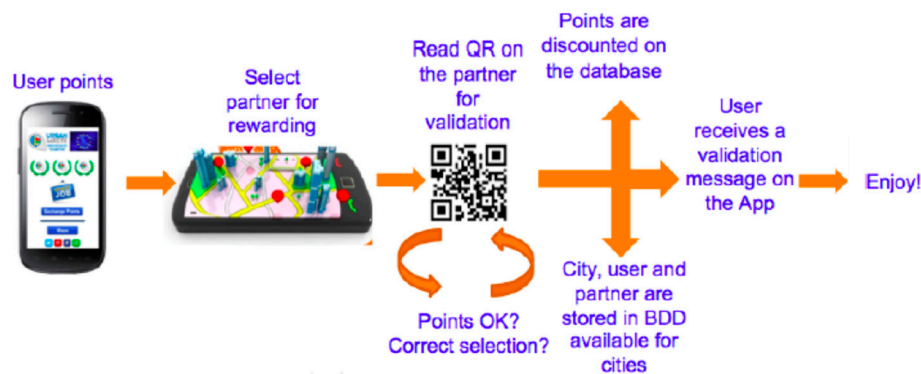


Figure 2. The WasteApp process of redeemed points by prizes. BDD refers to a database service [7].

The game must run on the most distributed operating systems for cell phones and each city was studied independently. The game philosophy is based on a points-reward strategy in which the users obtain points by reading QR codes located on waste bins.

The sensations to be evoked on the user include the following: usefulness; challenge (for the users looking for rewards); and social/ecology conscience. The mechanics proposed included providing information to the users about the waste collection infrastructure on an interactive map; QR codes on the waste bins for accessing to points, a prize list for each city and some eco-tips (waste related ecology tips) displayed on the users' screens after they read QR codes.

In a lower level of description, the application had not only a mobile-based interface but also a relational database and a server-side backend. Under this framework, the programmer and end-user sides address the design, since MDA flow is bidirectional. See [7] for technical details.

3. Tourist Recycling Behavior and Gamification

3.1. Tourism Behavior

Tourism, a source of wealth and employment around the world, is beginning to be considered a curse in some European destinations [12]. The benefits that tourism provides to local communities are well known: the generation of employment [13], the improvement of the quality of life of the native people, the increase of the profits of business, the creation of new infrastructures, the social enrichment for the exchange of cultures and the valuation of natural and heritage resources [14,15]. However, the negative impact generated by tourist activity takes longer to be noticed, being perceived, in the long run, as more significant than these widely proclaimed benefits. These adverse effects differ depending on the destination as well as the type of visitor and the activities they perform. But, in general, local citizens perceive facts such as: the overcrowding of infrastructures and public spaces, the increase in prices, the proliferation of companies focused exclusively on tourism, noise, citizen insecurity, drug and alcohol consumption, as well as the extra generation of waste and the presence of garbage in areas not designed for storage [16]. To all this, we must add that the tourism infrastructures areas can be overloaded, generally shared by citizens and tourists, but they are only sized to sustain the

citizen burden, which is to the detriment of adequate waste management [17]. There are a number of dissuasive techniques that are part of so-called demarketing strategies, which aim to change the tourist flow, leading visitors to sites where they supposedly cause less impact [18]. However, the UrbanWaste project has preferred a proposal aimed at encouraging certain behaviors that contribute to improving the image of the destination through gamification approaches [7].

Concerning the behavior of tourists, there is a direct influence between their attitudes and how the local population hosts them. Some visitors see the occasion of the trip as an excuse to break with the standards to which they usually have in their daily lives. The tourist would be outside the social norms of coexistence, remaining in an unreal world until returning to normality. However, this form of rupture varies depending on the individuals, some more prone than others to leave the norms of society [19]. To this, we must add the ignorance of visitors about local customs and regulations in aspects such as waste collection. These rules are usually different from those of their cities of origin, which increases the tourist's perception of being outside the local norms of coexistence [3].

The lifecycle of the destination is also important regarding the predisposition of the population towards its visitors [20]. In the beginning, the local community can find tourism attractive, but over time this perception disappears, and the stages of apathy, annoyance, and antagonism arise [21]. Nevertheless, technology tools promoting behaviors that are assumed as benefits by the society can also be used as persuasive tools to influence the ideas and reactions of the player-tourist.

One of the proposals of the aforementioned European project in which this work is framed is the implementation of an application that informs the regulations about the collection of waste as well as those areas of deposit for recycling closest to the user [6]. This study aims to elucidate if this type of initiatives promotes good environmental behavior of visitors and if it affects the image of the destination that sets them in motion.

3.2. Gamification and Sustainability

Within the different definitions proposed by various authors on gamification, the most accepted seems to be "use of game elements in non-play contexts" [22]. The psychological basis of the use of these elements is motivation that can be conceptualized in two distinct features: intrinsic, where a behavior or action is carried out because it is aligned with an internal value; and extrinsic where external awards such as money or status are offered in exchange for a continued commitment to a particular activity [23]. The idea is trying to create extrinsic motivators that are internalized and become intrinsic pseudo-motivators, that is, internalize the extrinsic motivators. In fact, in the design of an application, it is essential to use motivational tools, both intrinsic and extrinsic, so that the probability of obtaining the desired behavior increases. In addition, intrinsic motivators should be generalized as much as possible, because due to the considerable variability of individuals, it is necessary to cover the most significant number of people who are influenced by these motivators. This is necessary since it has been shown that intrinsic motivators produce greater satisfaction in the user-player [24]. There are a series of game mechanisms that have to be designed and are necessary to produce the player's motivation. Feedback and positive reinforcement are required through the recognition of achievement, gaining status with colleagues, friends, and family [23]. The gamified systems, although they are not games, are designed to take advantage of human psychology in the same way that games do. It seems that gamification is a more rewarding alternative, and therefore effective than traditional methods of motivation and loyalty because, in the game, motivation is inherent [25].

In other matters, a pro-environmental behavior is one that develops an individual or a group that promotes or results in the sustainable use of natural resources, the environmentally responsible behavior reflects an individual's environmental commitment, concern, and knowledge [26,27]. The awareness of the sustainability of resources is increasingly present in today's society. This awareness is due to different factors such as an improvement in environmental legislation, greater public pressure, an increase in social consciousness, the echo that the media makes of environmental issues, problems arising from their shortage and, above all, the change of public opinion [28,29]. In the field of tourism,

the sustainability of resources is a fundamental issue for maintaining the reputation of the destinations and their power of tourist attraction, and hence sustainability remains a pending issue. It must be borne in mind that both the competitiveness of the destination and many of the tourist activities that take place in it depend on the quality of its resources, and this quality depends on its sustainable maintenance. Those destinations whose target audience are tourists concerned about the environment are more likely to maintain a sustainable destination reputation [30].

For a gamified application to increase its probability of achieving a change in behavior, it is essential to ensure that there is a normative influence among the members of a digital community. In other words, a member can begin to recycle to adapt to the pro-environmental behavior of the rest of the members in a way that produces a feeling of acceptance [31].

On the other hand, the elements of the game create opportunities for the social diffusion of ideas and behaviors, which makes actions that are intrinsically private visible to friends and colleagues [32]. Another advantage that gamified applications can provide to the player is concrete information on how to develop their recycling behavior. Often tourists do not have information on standards and schedules for selective collection of waste in the area they visit [33]. It is possible that their intervention is more effective if tourists receive specific and easy to understand instructions that will allow them to know how, when and where they should act [34].

As indicated earlier, a gamified application of sustainability seeks to support and encourage sustainable behaviors such as helping recycling behavior, reducing waste or saving energy. The initiatives developed to promote pro-environmental behavior, and explicitly recycling, have been designed as isolated experiments (placing a separate container that produces sound and light stimuli when the action occurs). However, the proposal where the pilot project of this study is framed tries to reach a higher number of citizens through the application, WasteApp, which encourages these behaviors while informing about nearby recycling areas, using gamification tools.

There is no lack of criticism of these gamification tools used by areas as diverse as education, government, and marketing. It is said to be a form of perversion and exploitation of the game medium to obtain an easy-to-obtain benefit. The idea is that the industry intends to displace the real incentives that are used to encourage some behavior by fictitious incentives [35]. Other critical sources question the ethics of using the game to change human behavior, what has been called the gamipulation, the manipulation of behavior through game tools [7].

4. Hypothesis Development

4.1. Technology Acceptance Model (TAM) and User Satisfaction

Since the first studies on the adoption of technology, it has been assumed that the user makes a rational decision-making process based on the cost-benefit binomial. Therefore, and based on the theory of reasoned action, the technology acceptance model (TAM) considers that the two primary characteristics necessary to accept an information system are: perceived ease of use and perceived utility [36,37]. On the other hand, it has been found that user satisfaction is directly related to the usability of the application, the ease of navigation, interactivity, and responsiveness [38].

Previous studies indicate that the perceived usefulness of the application has a direct effect on user satisfaction [39,40]. It is more likely that the end users will be more satisfied if they believe that using the system will increase their performance in the target of the application [41,42].

Another notable aspect developed in previous studies is the indirect effect that perceived ease of use exerts on user satisfaction through perceived utility, which indicates that the user considers the application less useful if he or she finds it difficult to use [43,44]. Besides, it is noted that although the perceived ease of use and the perceived usefulness have a direct influence on the intention to use the application (as TAM says), however, in the case of user satisfaction, the effect is indirect, the perceived ease of use exerts its influence on user satisfaction through the perceived usefulness [45].

Based on the above arguments, the following hypotheses have been put forward:

H1. *Perceived ease of use concerns about the gamified app will positively affect perceived usefulness concerns about the gamified app.*

H2. *Perceived usefulness concerns about the gamified app will positively affect user satisfaction concerns about the gamified app.*

4.2. User Satisfaction and Recycling Behavior

The game tools used by the gamification strategies produce in the user a state of flow that, intrinsically, motivates the citizen to repeat sustainable actions; that is, a habit is formed thanks to gamification. This state of flow may correspond to the user's satisfaction. Some authors consider that flow is closely related to user satisfaction and the acceptance of information technology [46]. Furthermore, it is possible to find studies in the field of health that have shown that a new behavior becomes a habit through repetition. They imply that the frequency of this new behavior is significant so that it ends up engaging people to the practice [47]. More importantly, the formation of this habit leads people to maintain the action in the long term, even without the need to use gamification as an element of motivation [48]. The change in long-term behavior will only occur if people execute sustainable behavior many times and end up internalizing it. Recent research maintains that gamification manages to keep pro-environmental behavior over time and produce a change in long-term behavior [49].

The reinforcement of behavior is one of the effects of gamification, a result that seems to be more effective than punishment [50]. As a consequence of this, a causal effect is produced, the gamification increases the satisfaction of the users when they are regularly informed about their progress and continuous feedback is offered on the objectives that they are achieving. This fact allows a feeling of high individual performance that reinforces the behavior that the application promotes [51].

The psychological benefits, among which is the satisfaction with the application, cause a commitment to use it. Based on the theory of planned behavior, it is expected that user satisfaction will have a positive influence on the contribution to the action of recycling [52,53].

Based on the above arguments, the following hypothesis has been put forward:

H3. *User satisfaction concerns about the gamified app will positively affect recycling behavior.*

4.3. Expectation about Awards

The elements of the game reinforce the individual's motivation by creating competition among the players. It is important to note that when a tangible award is given, people tend to believe that they perform the behavior strictly for the prize and not because they are inherently interested [54]. Similarly, the theory of self-perception suggests that people will attribute pro-environmental attitudes if they realize that they perform sustainable actions without external awards [55]. In the case of receiving this type of award, as soon as the competition ends the behavior changes. For this reason, the awards must be small [56]. That is, the relationship between the promoter of the behavior and the tourist only lasts as long as the prize, free stuff, is promoted, which on the other hand is expensive and less effective [24].

However, in some contexts (educational, organizational), the behaviors are reinforced with awards perceived as useful, for this reason, a perceived compensation with attributes of quality can influence the perception of the usefulness of the system. For that same reason, it seems logical to think that this prize seen as quality can produce a positive effect on the user's satisfaction with the system [36,57].

Finally, the award demonstrates an acknowledgment of an effort made to develop a behavior that seeks to encourage the application, so that recognition through the prize should have a positive effect on helping that behavior [58]. Furthermore, a new participant in a community must receive feedback and an award to induce their participation, this interaction with the system creates a positive reinforcement that builds in the tourist-player a commitment to the behavior promoted by the gamified system. That is, the expected awards influence the attitude towards practice, as long as that award exceeds in value the appreciated costs of the behavior [59–61].

Based on the above arguments, the following hypotheses have been put forward:

H4.1. *Expectations about awards will positively affect perceived usefulness.*

H4.2. *Expectations about awards will positively affect user satisfaction.*

H4.3. *Expectations about awards will positively affect recycling behavior.*

4.4. *Word of Mouth (WoM)*

The perceived usefulness of a product or service seems to have a positive influence on the client's intention to recommend it, that is, the word-of-mouth effect should be met as long as the utility of what is offered is perceived. However, it must be clarified that the literature states that for this relationship to work the usefulness must be combined with the originality of the product. In this specific case, if the tourists perceive the application as useful during their visit to the destination, they will divulge this kindness among acquaintances [62].

The degree of satisfaction of the individual with the experience of the service is a precedent to recommend it [63], this degree of satisfaction generates a positive effect from word of mouth (WoM) [64]. It has been found that those customer-travelers who are delighted with a service are more likely to proclaim favorable review. Furthermore, the intentions of a user's behavior are a consequence of the perceived values; therefore, if users are satisfied with an application, they will recommend it; even if they recognize that this application has contributed to their pro-environmental behavior they will also proceed in their intention to WoM it [65,66].

On the other hand, the motivation to participate in a positive WoM behavior may be due, for some to a desire to improve themselves and for others to a hope to gain social status [67]. That is, the pro-environmental behavior derived from the user's satisfaction provokes a sense of altruism that makes the individual want to recommend the application as a kind of exposure to his friends and acquaintances [7,68].

Based on the above arguments, the following hypotheses have been put forward:

H5. *Perceived usefulness will positively affect gamified app WoM.*

H6. *User satisfaction will positively affect gamified app WoM.*

H7. *Recycling behavior will positively affect gamified app WoM.*

4.5. *Tourism Destination Reputation*

The sum of experiences in previous trips allows tourist to form their own image of the destination. Among the factors that make up that image of destination are their perceptions of the cleanliness and care of the place they visit. Initiatives such as the promotion of environmental behavior contribute to a good reputation as a sustainable destination [69].

The importance of the physical environment is underlined in the literature as an element that contributes to the image and reputation of the destination [70,71]. The tourism industry, more than any other, uses the environment as a factor of production [72]. Social responsibility initiatives such as the promotion of recycling behavior through a gamified application could be a remarkable factor that contributes to increasing the destination reputation.

Several studies state that environmental initiatives affect the perception of tourists, thus influencing the reputation of the destination and the image they create of it. Sustainable and responsible initiatives demonstrate the concern of firms about the effects of their operations, in the same line, a destination that builds this type of program will be able to gain the trust of its visitors and obtain a positive reputation among them [73,74].

Based on the above arguments, the following hypothesis has been put forward:

H8. Recycling behavior concerns about the gamified app will positively affect the tourist destination reputation (see Figure 3).

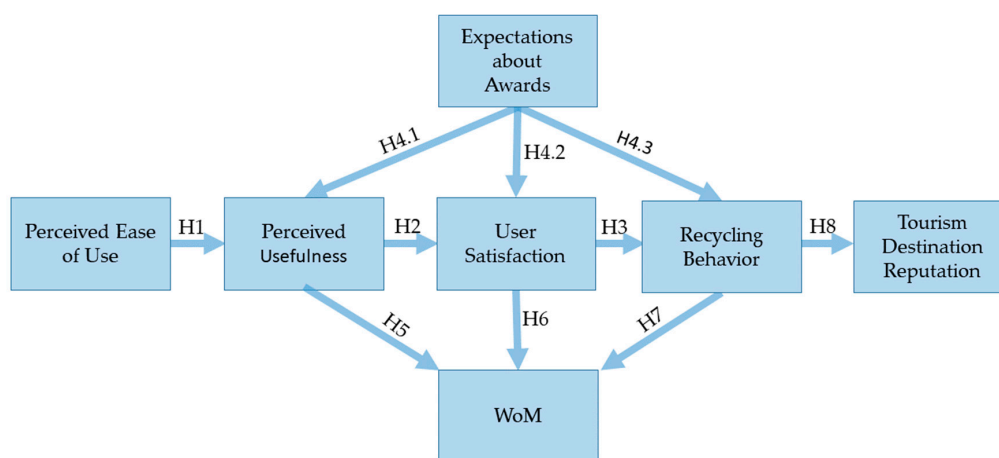


Figure 3. Research model.

5. Research Methods

5.1. Sampling Procedure and Sample

Survey data were collected from 141 participants who were asked to answer a questionnaire after using the application in a field experiment carried out in the pilot cities from France, Spain, and Portugal selected by the UrbanWaste committee. The experimentation has been carried out within controlled environments due to the strict European regulations on data protection and privacy.

The survey was conducted throughout 2018, using a convenience sampling where tourists were selected because of their accessibility and proximity to the researcher. As listed in Table 1, 75 (53.2%) of the respondents to the questionnaires were female, and 65 (46.1%) were male; 92 (46.1%) of the respondents were aged ≤ 24 , and 49 were aged > 24 . The most substantial proportion of respondents had an upper-middle social status (81, 57.5%), followed by middle status (25, 17.7%).

Table 1. Demographic information for the sample.

Characteristics		Frequency	%
Gender	Male	65	46.1
	Female	75	53.2
	Other	1	0.7
Age	≤ 24	92	65.3
	> 24	49	34.7
Social Status	Lower	4	2.8
	Lower-middle	15	10.7
	Middle	25	17.7
	Upper-middle	81	57.5
	Upper	16	11.3
Total		141	100

5.2. Measurement and Analysis Method

All the variables were measured using scales adapted from previous studies [36,45,52,59,63,71,74–76]. Items were measured on a seven-point Likert scale in which 1 = strongly disagree, and 7 = strongly agree. The research model is composed of the following variables:

- Perceived ease of use (PEU) was estimated with four questions adapted from [36,45], using the following items:
 - “I think the navigation menu is intuitive enough.”
 - “I think the tutorial clearly explains the use of the application.”
 - “I find it easy to use the application.”
 - “I think the messages from the application are easy to understand.”
- Perceived usefulness (PU) was measured with four items adapted from [36,45]:
 - “I think the application is useful to encourage recycling behavior.”
 - “I think it is easy to find the closest recycling bin on the application map.”
 - “I think the information about the recycling areas is correctly on the application.”
 - “I find the application useful when I travel.”
- User satisfaction (US), was estimated with four items adapted from [45,75]:
 - “I think it is worth using this application.”
 - “I think the application covers my expectations over the applications.”
 - “I like using the application during a trip.”
 - “I would use the application frequently on a trip.”
- Recycling behavior (RB), was measured with three questions based on [52]:
 - “I think the application encourages recycling behavior.”
 - “I think the use of the application promotes measures that produce a cleaner destination.”
 - “I think the application can change the behavior towards the recycling of some people.”
- Expectation about awards (EaA) was measured with four items adapted from [63]:
 - “I would like the prize to be useful.”
 - “I would like the prize to be valuable.”
 - “I would like the prize to be easy to obtain.”
 - “I would like the prize to be nice.”
- Application WoM (WoM) was estimated with four questions adapted from [71,74]:
 - “I would recommend WasteApp to my friends.”
 - “I would recommend WasteApp to my neighbors.”
 - “I would recommend WasteApp to my acquaintances who are aware of environmental.”
- Tourist destination reputation (TDR) was estimated from four questions based on [59,76]:
 - “In my opinion, the apps improve the image of the city.”
 - “I think the cities that use the application will attract more tourists.”
 - “I think the application increases the satisfaction of my experience in a city.”
 - “I would repeat the journey to a city that uses this application.”

6. Results

6.1. Measurement Model

All data were analyzed using path equation modeling in Amos software. Path analysis is a multivariate method that allows verification of the adjustment of causal models as well as identification of the direct and indirect contribution whereby they make a set of independent variables to explain the variability of dependent variables [77]. Construct validity and the reliability of the measurement

model were assessed based on confirmatory factor analysis. All values of composite reliability and Cronbach's α were greater than 0.7. The indicator reliability was evaluated based on the criterion that loading should be higher than 0.7 and that every loading below 0.4 should be eliminated [78]. Only one loading was slightly less than 0.7 while the rest of the loadings were higher than 0.7 and statistically significant at 0.01, confirming good indicator reliability for the instrument (see Table 2). The validity test was analyzed using the average variance extracted (AVE), and all constructs were greater than 0.5 [79]. All constructs of the square root of AVE were higher than the correlation between other variables [79]. Discriminant validity was verified (see Table 3).

Table 2. Descriptive analysis.

Items	Cross Loading	Composite Reliability	AVE	Cronbach's α
PEU1	0.909	0.894	0.684	0.805
PEU2	0.854			
PEU3	0.904			
PEU4	0.604			
PU1	0.804	0.861	0.609	0.755
PU2	0.856			
PU3	0.740			
PU4	0.713			
US1	0.862	0.960	0.857	0.943
US2	0.956			
US3	0.955			
US4	0.928			
RB1	0.937	0.969	0.913	0.951
RB2	0.966			
RB3	0.964			
TDR1	0.846	0.947	0.817	0.930
TDR2	0.913			
TDR3	0.935			
TDR4	0.919			
EaA1	0.952	0.967	0.880	0.951
EaA2	0.928			
EaA3	0.946			
EaA4	0.926			
WoM1	0.911	0.904	0.704	0.934
WoM2	0.890			
WoM3	0.795			
WoM4	0.749			

PEU = perceived ease of use, PU = perceived usefulness, US = user satisfaction, RB = recycling behavior, TDR = tourism destination reputation, EaA = expectation about awards, WoM = word of mouth, AVE = average variance extracted.

Table 3. Test of discriminant validity.

	1	2	3	4	5	6	7
PEU	0.827						
EaA	0.364	0.938					
PU	0.625	0.556	0.807				
US	0.060	−0.069	0.230	0.938			
WoM	0.218	0.113	0.115	0.571	0.916		
RB	0.217	0.101	0.156	0.494	0.892	0.971	
TDR	0.167	0.097	0.073	0.468	0.778	0.833	0.918

* Diagonal elements (bold) show the square root of the average variance extracted (AVE).

6.2. Hypothesis Testing

The assessment of the adjustment aims to determine whether the relationships between the variables of the estimated model adequately reflect the correlations observed in the data. There are three types of adjustment goodness statisticians. First, those that value the absolute adjustment (square chi); second, there are some that compare the adjustment concerning another model, relative adjustment (comparative fit index, CFI); finally, those using parsimonious adjustment that evaluate the fitting according the number of used parameters (normed-fit index, NFI). None of these parameters provide all the necessary information to evaluate the model, so usually some of them are used simultaneously [77]. Furthermore, the variance-covariance matrix was used to test the research mode. Before verifying the hypotheses, we confirmed the fit of the path model. As shown in Table 4, all the fitness indices ($\chi^2/df = 1.092$, NFI = 0.978, Tucker-Lewis index (TLI) = 0.996, CFI = 0.998, root mean square error of approximation (RMSEA) = 0.026) signaled a good model fit.

Table 4. Model fit for structural model test.

Fit Index	χ^2	χ^2/df	NFI	TLI	CFI	RMSEA
Criterion	$p \geq 0.05$	≤ 3	≥ 0.9	≥ 0.9	≥ 0.9	≤ 0.08
Research model	10.925 ($p = 0.363$)	1.092	0.978	0.996	0.998	0.026

The results of the analysis are shown in Table 5. The perceived ease of use (PEU) ($\beta = 0.486$, $p < 0.001$) had statistically significant effects on the perceived usefulness (PU). Therefore, Hypothesis 1 was supported. The perceived usefulness (PU) ($\beta = 0.221$, $p < 0.1$) had statistically significant effects on user satisfaction (US); consequently, Hypothesis 2 was supported. The user satisfaction (US) influenced on recycling behavior (RB) significantly ($\beta = 0.505$, $p < 0.001$), so Hypothesis 3 was supported. The relationship between expectation about awards (EaA) and recycling behavior (RB) was not statistically significant, and the expectations about awards (EaA), contrary to expectations, had a negative effect on user satisfaction (US), but EaA had statistically significant effects on perceived usefulness (PU) ($\beta = 0.379$, $p < 0.001$). As a result, Hypothesis 4.1 was supported; Hypothesis 4.2 was not supported, and Hypothesis 4.3 was rejected, so Hypothesis 4 was partially supported. Moreover, perceived usefulness (PU), user satisfaction (US) and recycling behavior (RB) influenced the intention of recommending the application (WoM) ($\beta = 0.110$, $p < 0.1$) ($\beta = 0.140$, $p < 0.1$) ($\beta = 0.714$, $p < 0.001$) and hence the Hypothesis 5, Hypothesis 6, and the Hypothesis 7 were supported. Finally, the influence of recycling behavior (RB) was significant on tourism destination reputation (TDR) ($\beta = 0.827$, $p < 0.001$), thus Hypothesis 8 was supported (Figure 4).

Table 5. Hypothesis test.

	Path	Estimate	S.E.	Sig.	H Test
H1	Perceived ease of use \rightarrow Perceived usefulness	0.486	0.063	0.000	Supported
H2	Perceived usefulness \rightarrow User satisfaction	0.221	0.100	0.027	Supported
H3	User satisfaction \rightarrow Recycling behavior	0.505	0.073	0.000	Supported
H4.1	Expectations about awards \rightarrow Perceived usefulness	0.379	0.063	0.000	Supported
H4.2	Expectations about awards \rightarrow User satisfaction	-0.192	0.100	0.055	No supported
H4.3	Expectations about awards \rightarrow Recycling behavior	0.078	0.073	0.289	Rejected
H5	Perceived usefulness \rightarrow Application WoM	0.110	0.049	0.025	Supported
H6	User satisfaction \rightarrow Application WoM	0.140	0.056	0.013	Supported
H7	Recycling behavior \rightarrow Application WoM	0.714	0.056	0.000	Supported
H8	Recycling behavior \rightarrow Tourism destination reputation	0.827	0.047	0.000	Supported

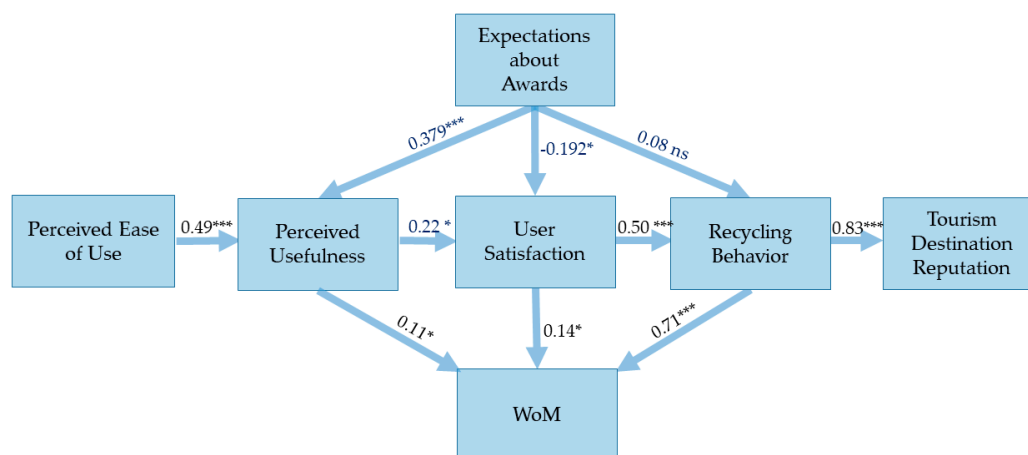


Figure 4. Result model. * probability < 0.10; ** probability < 0.05; *** probability < 0.01; ns = non-significant.

7. Discussion and Conclusions

Tourist recycling behavior is a problem faced by some European cities that suffer from seasonal tourism that raises the floating population far above the permanent one. This problem affects the quality of life, not only of its visitors but also of the habitual inhabitants of these overexploited zones. Among the detected issues is the lack of information on recycling points, this coupled with the fact that tourists have a sense of being exempt from social norms while on vacation and out of their usual environment, creating problems in specific areas such as the accumulation and indiscriminate mixing of waste [18,19].

The UrbanWaste project, among other initiatives, intends correct that lousy image of the destination and contributes to travelers using the means that the city puts in their hand, and that, consequently favors the reputation of the town. Through the efficient use of resources, smart tourism is expected to have a positive effect on the sustainability of the destination. For this, it takes advantage of the persistent use that the travelers make of smartphones during their visit. It uses this circumstance an alliance to promote pro-environmental behavior. The WasteApp application, based on gamification, aims to encourage and activate mechanisms that produce a habit of recycling behavior in visitors [22]. This study investigated whether the use of this application, which utilizes game elements, can promote pro-environmental habits and, therefore, improve the image of the tourist destination that implements it.

The work presented here is the continuation of a previous one where the most relevant factors were added so that the design of the WasteApp would be successful in its objectives [7]. In this study where TAM approaches are incorporated, it is demonstrated that the ease of use and the utility of the application have influenced the satisfaction of the user, although the first is an indirect effect that affects satisfaction through the second [45]. The ludic components of the application were not considered since in the previous study it was concluded that the visitor does not expect large elements with playful functions of the application [7,37].

In terms of the quality of the expected awards, they influence the perception of the utility of the application. However, these expectations do not influence the recycling behavior. This last factor is not free of controversy, since, according to some authors, as soon as the relationship between the application and the traveler ends, the commitment to the promoted recycling behavior may disappear as well. That is why it is necessary that the awards allow the internalization of extrinsic motivation, for example making gifts that promote the sustainability of the destination or be perceived as useful to the tourists. Besides, and contrary to expectations, the expected quality of the award does seem to influence the satisfaction of the user of the application, but negatively. This fact may be due to the users' perception of their pro-environmental behavior as a duty to the community. Consequently, their satisfaction emanates from an intrinsic motivation, which makes them perceive the physical

awards, extrinsic motivation, even contrary to their conscience [24,25]. Since the expected quality of the award influences tourist perception about the utility of the application, and in line with recent studies that propose a design focused on the preferences of the users, it would be pertinent for the cities that implement gamified applications to take into account these preferences among visitors [8].

On the other hand, this satisfaction of the user will have a positive influence on the factor of recommending the application. At the same time, the promoted behavior will also support the desire to recommend the app. This fact is probably due to two reasons related, firstly, to the traveler seeing the application as an aid to pro-environmental behavior and, secondly, to the tourist's desire to expose their acquaintances and friends to action that is usually private, and that will report a favorable image to their social networks [32]. This exposure of the application to different agents will cause its visibility in the networks in which the traveler is immersed. Finally, the great beneficiary of this pro-environmental behavior and the use of the application will be the image of the destination that will improve its reputation through the use of the application.

An interesting finding of this study is the connection between the satisfaction of users and the creation of a behavior habit, since the more satisfied they are, and the more they want to recommend the application, the more their pro-environmental behavior will be promoted. This chain of actions may result because the satisfaction with the application comes from a combination of intrinsic and extrinsic motivations of the users. That is, the visitors are satisfied with the app because it helps them in their pro-environmental behavior emanating from an altruistic feeling and which aims to preserve the environment (intrinsic motivation), but also they recommend the application to the people in their setting to present themselves with a benevolent image (extrinsic motivation). The result is a profitable, beneficial habit not only for the visitors who present that good image before their acquaintances, but the reputation of the destination will be reinforced. Another important finding, this time facing the municipalities, is that this type of initiatives is very well accepted by tourists and will produce an improvement in the image of the destination, shaping it as a sustainable and intelligent destination.

However, perhaps the most significant finding is detected in the fact that, although specific physical awards must be given, these should not be perceived as excessive quality, although they should be seen as useful and as aids to the behavior promoted. Curiously, tourist satisfaction will come from other channels, originated more by the intrinsic motivations of their satisfaction than by extrinsic ones. That is, although small doses of extrinsic motivation are favorable to promote the objective-behavior of the application, it is the intrinsic motivation that weighs more on the visitor's mind.

Concluding, according to our study and as already mentioned, this type of initiative seems to be accurate and should be promoted from the institutions with the objective, not only to improve some behaviors of visitors but, ultimately, develop a more desirable reputation of an oversaturated destiny.

This work also has opened new research guidelines to study, and has limitations due to the testing group size and components. It has been developed in an environment of medium-high socioeconomic level, and therefore these subjects are supposed to be more aware of the environment. In addition, most of the respondents are European, so it should be extrapolated to other regions of the world. Another obstacle with which the project has been found, is the strict regulations held by some European cities do not allow the delivery of physical prizes for these behaviors through platforms promoted by the municipality, as in the case of Copenhagen. Besides, the use of the questionnaire limits the approach to information gathering, although its application in studies of attitudes may be deemed suitable. New research will continue this work in several aspects, such as the effect of promoting "good practices" on recycling behavior, limiting the rejection of excess tourism in saturated destinations, or how travelers in collaborative houses can be integrated into the sustainability ecosystem of cities.

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