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A literature review of e-government services with gamification elements

Keywords

Gamification, E-government, Smart cities, Maturity models, Game elements

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A literature review of e-government services with gamification elements

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Abstract

Nowadays, many democracies are facing, as a growing problem, a breach of communication between citizens and political representatives, resulting in a low citizen participation in political decision-making and during public consultations, leading to a low engagement. Therefore, it is fundamental to generate a constructive relationship between the public administration and the citizens by solving their needs. This document contains a useful literature review of the gamification topic and e-government services, providing a conceptual background and presents a selection and analysis of the different gamification applications found. Three lines of research gaps were identified, with a potential impact on future studies.

Keywords: Gamification, E-government, Smart cities, Maturity models, Game elements

1. Introduction

Nowadays, many democracies are facing, as a growing problem, a breach of communication between citizens and their political representatives. This breach results in a noticeable decrease in citizen participation during political decision-making and public consultations, ultimately leading to a low engagement level. This decline is causing politicians to worry about their position as legitimate citizen representatives. Therefore, it is fundamental to generate a constructive relationship between the public administration and the citizens by solving their needs. This issue is at the core of the effort many governments are making towards implementing a new type of management and citizen interaction system coined as e-government. E-government is applied around the world at different levels or stages (Lee et al., 2005) and implies a maturity level in relation to certain conceptual frameworks. Nevertheless, a considerable number of implementation attempts is facing difficulties because of low user engagement due to

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different causes, which are identified by some of the cited authors included in this overview.

Gamification as a strategy has been partially successful in other domains such as the business context, where different gamification features can be integrated into products, websites or services. Gamification means bringing about similar positive experiences to those of games and consequently, affect user behaviour and cognitive processes (Hollebeek; 2011). Mainly inspired by games, gamification commonly applies game mechanics. Authors such as Peng et al. (2012), and Hamari and Tuunanen (2014) make a distinction between 3 categories of gamification mechanics and game-design which are directly related to gaming motivations: immersion-related, achievement-related and social-related dimensions. Immersion-related features pursue to immerse the user in a self-directed activity and include storytelling, avatars or role-play as game mechanics. On the other hand, achievement-related features seek to increase the user's sense of accomplishment and include challenges, badges, missions, leaderboards, goals or progression metrics as game mechanics. Finally, social-related features pursue to enable user social interaction and include collaboration and cooperation structures as game mechanics. Thus, gamification may be a useful tool to increase citizen motivation and hence, their use of open government data (Coronado Escobar and Vasquez Urriago; 2014). Although the current body of literature suggests that gamification may have a positive effect on users (Hollebeek; 2011), and that gamification has become an important topic, with a considerable number of research articles in relevant indexing services (Al-Yafi and & El-Masri; 2016), the mechanisms of how gamification may impact citizen engagement using e-government services continues unclear due to a lack of empirical evidence within this area. Some researchers (Hollebeek; 2011) agree that there is a general lack of models to help us understand and define gamification, as well as initiatives that could serve as a starting point for a successful implementation. Public managers could apply gamification strategies to open government systems in order to increase satisfaction among citizens while using e-government platforms (Coronado Escobar and Vasquez Urriago; 2014). There seems to prevail a lack of methodology when selecting the gamification elements due to the complexity of social interactions between the user and e-government services. In response to this research gap, the present article aims to identify and summarise the current theoretical models of gamification and e-government, highlighting the best practices, research approaches, and pioneer projects, by conducting a literature review to identify, evaluate and interpret all available research relevant to this field. This paper counts with seven sections. The present Introduction corresponds to Section 1 and provides an overview to the concept of gamification and the need to systematise the knowledge produced. Section 2 summarises the Methodology and Section 3 presents the Literature review. Subsection 3.3 includes the Results report, Subsection 3.4 presents a Review of selected articles, and Section 4 contains the Discussion and Research recommendations. Finally, Section 5 includes the Conclusions.

2. Methodology

This literature review used the work of [Kitchenham and Charters \(2007\)](#) as a guide to conduct a research-gap analysis. The following points summarise the process:

Topic / Questions reviewed: this work aims to identify how gamification has been implemented in different public/e-government services. The informed maturity level is also analysed. What cohesion degree does the service have in relation to the citizen? What kind of framework or gamification elements have been used? And most importantly, what tools were employed to assess their impact?

Keywords search: the search was focused on the concepts of 'gamification' + 'government/e-government' as key terms.

Article sources: literature was gathered by searching different databases that index academic material such as Google Scholar, Microsoft Academic, CiteSeerX, ScienceDirect, BASE, Iopscience, Arxiv.

Background (literature review): includes the definition and delimitation of the two concepts to be analysed: (1) what types of services are established according to the degree of e-government model, and (2) what are the gamification elements, the source of motivation, and the available tools.

First selection: the review includes articles which are part of a book, scientific papers, conference proceedings or thesis published in an academic environment. Non-academic publications, general journal articles, web articles and publications that do not contain at least two of the key terms have been excluded. The material was first filtered by reviewing the article title and keywords provided by the author, which had to include keywords such as 'government', 'citizen', 'service', 'city', 'gamification', and their synonyms. Then, after this first screening, the remaining material was checked again, focusing on the second portion of the abstract, where the key concepts and the conclusion are typically found. Whenever the abstract included the keywords or the concepts of interest, a review of the section titles and a word search including the terms 'elements', 'framework', 'gamification', 'service' and 'government', was performed. The keywords and their location on the body of the document were noted down and registered in a summary spreadsheet for each selected item. Any publication including more than half of the keywords was selected for this study.

Second selection: the introduction section was analysed in order to identify the objectives of each work. Articles that included the analysis or implementation of gamified services as objectives were selected, and the rest were discarded. These documents were reanalysed, identifying the main ideas in relation to the type of gamification elements applied. Additionally, the methodology employed, and the quality of the results/conclusions were also considered. The final selection was comprised of articles that referred to any kind of applied gamification elements, their design, or the assessment of a gamified service.

Review of selected articles: the analysis of the final selection of publications was carried out by evaluating the documentation work and methodology applied by the author(s), the gamification elements used, and how the impact of their results was evaluated qualitatively and quantitatively.

Analysis of the selected articles: An analysis of the articles found is carried out evaluating the procedure, the gamification elements used, and the process of results impact evaluation.

Discussion and research recommendations: this section focuses on discussing possible improvements and future research that could contribute to creating a new methodological framework for researchers working on the implementation of gamification to public services.

3. Literature review

In order to carry out this literature review, it is necessary to investigate how the level of penetration (maturity level) of e-governments is defined according to the literature. Various models have been established with the purpose of quantifying the maturity of these services. This section focuses on their defining characteristics. The concept of gamification and its theoretical foundation, i.e., human motivation, is also explained. This section compiles some examples of frameworks and models used to evaluate the application of gamification.

3.1. Gamification theory and motivation

According to [Hutter et al. \(2011\)](#) and [Wijnhoven et al. \(2015\)](#), to understand the principles of gamification, it is necessary to comprehend the sources of human motivation. [Hutter et al. \(2011\)](#) suggest that the main rationale for participation is political interest. [Wijnhoven et al. \(2015\)](#) expand on previous findings, and they found out that citizen motivation to participate depends on the type of project. Furthermore, they are more prone to participating in projects where they receive feedback on the results. This hypothesis is confirmed by subsequent studies, such as the survey carried out by [Wirtz et al. \(2018\)](#), which empirically found higher correlations between the perceived usefulness of the participation and the intention to collaborate through e-government services. This is directly related to the user experience, and some authors such as [Hassenzahl \(2008\)](#) analyse the two perspectives from the user's point of view: how they feel about performing a specific task and how their needs are met.

[Goldfinch et al. \(2009\)](#) examined the relationship between trust, government, and political interest. Their empirical research revealed no relationship between citizen trust and political participation, but they found out that e-government communication stimulates political participation, as [Hutter et al. \(2011\)](#) also concluded.

However, even though citizens are intrinsically motivated to cooperate with public administrations, they may encounter several obstacles, as [Goodspeed \(2011\)](#) and [Janssen et al. \(2012\)](#) pointed out. For instance, the rigidity of some municipalities regarding user

access to information about projects and data subject to protection or legal restrictions, had a negative effect. Nevertheless, authors like [Veeckman and van der Graaf \(2018\)](#) address some of the previously identified barriers with a toolkit that allows everybody to participate.

3.1.1. User's motivation

According to [Miller et al. \(1988\)](#), user motivation can be divided into two distinct categories according to their origin: intrinsic and extrinsic motivation. Recent studies analyse these two concepts in connection with the current issue of gamification ([Wirtz and Götzel, 2016](#); [Zichermann and Cunningham, 2011](#); [Fadel et al., 2014](#)).

[Zichermann and Cunningham \(2011\)](#) indicate that intrinsic motivation is achieved through activities that generate challenges or are enjoyable. On the other hand, extrinsic motivation is only achieved through rewards, either of a material nature, such as gifts, access to exclusive areas or discounts; or virtual items, like exclusive badges that lead to a distinctive status within and across communities or that contribute to earning special recognition in different social networks.

There are several models ([Vallerand and Ratelle, 2002](#); [Kim et al., 2015](#)) that connect the type of motivation (intrinsic and extrinsic) with various categories of rewards and recognition.

3.1.2. Gamification Models - Frameworks

Several frameworks and models take the opportunity to exploit the motivation factors through the creation of the necessary game elements. [Hunicke et al. \(2004\)](#) created the most widely known framework, the Mechanics-Dynamics-Aesthetics (MDA), presented in [Figure 1](#). The first part, or game mechanics, includes the basic actions that players can take in a game, responses, algorithms, stored data, etc. Game dynamics are the run-time behaviour of the previously defined mechanics in response to the player input and to the interaction among other types of mechanics. Lastly, game aesthetics are the emotional responses produced in the player.



FIGURE 1: Mechanics-Dynamics-Aesthetics (MDA) framework elements.

Another well-known framework is the Six Steps to Gamification or The Six D's by [Werbach and Hunter \(2012\)](#), presented in [Figure 2](#). It counts with the following elements: (1) define the objectives that you want to achieve, (2) delineate the target behaviours that you expect from the users, (3) describe your players' profile (interest, what drives them), (4) devise activity loops (the process that the users have to follow), (5) don't forget the

fun (think what make your users return) and (6) deploy the appropriate tools (how the interaction will be measured, score systems, badge assignments, etc).

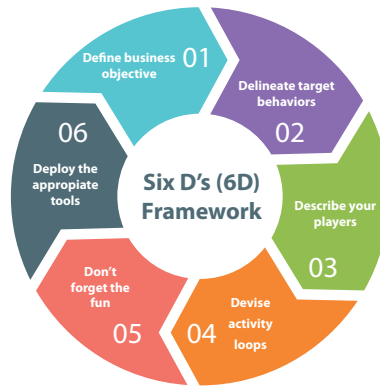


FIGURE 2: The Six D's (6D) framework.

Marczewski (2013) proposed a framework called GAME, with a more straightforward methodology and four components: (1) gather what information will be collected, (2) design the best solution for your goals and the experience of your users based on the information that you have (3) monitor the user activity and goals, iterate improvements and (4) enrich your solution over time to match the changes in society. This methodology evolved into the RAMPS motivation model and, later, into the User Types Hexad Scale, which is used to identify the types of users, as displayed in Figure 3.

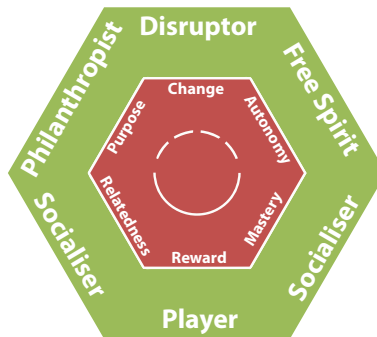


FIGURE 3: User Types Hexad Scale. The outer hexagon, in green, reflects the type of user. The inner hexagon, in red, displays the motivation per each type of user.

Chou (2015) proposed the Octalysis framework, that focuses on human design rather than functional design. This framework is depicted in an octagon shape determined by the core drivers, as seen in Figure 4. According to the author, the right side of the octagon reflects intrinsic motivation factors, and the left side, the extrinsic motivation.

The Gamification Model Canvas, elaborated by Jiménez (2013), and based on the Business Model Canvas, as seen in Figure 5 is another important, flexible and agile tool that enables representing in a single page all the necessary elements, tasks and expected

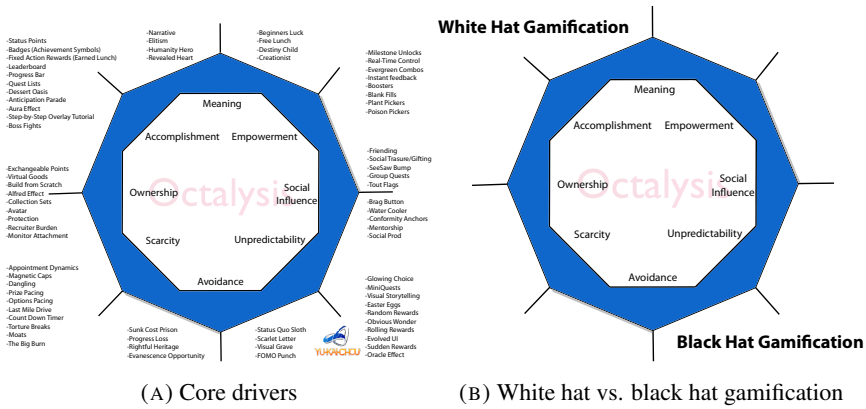


FIGURE 4: Yu-kai Chou's Octalysis model.

results of the gamified environment.

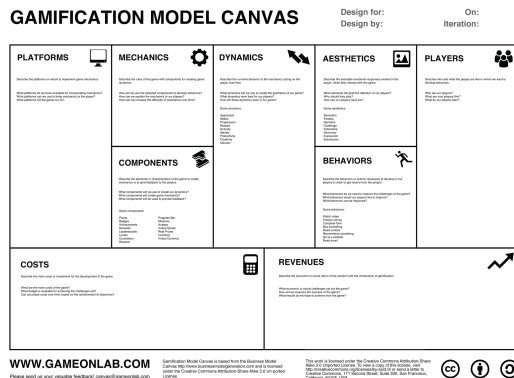


FIGURE 5: Gamification Model Canvas, with a display based on the Business Model Canvas.

The work conducted by [Toda et al. \(2019\)](#) compiles a full taxonomy of gamification models. According to the literature, the previously mentioned frameworks were used in different applications. For instance, [Coronado Escobar and Vasquez Urriago \(2014\)](#) discuss the possible use of the Octalysis model to generate trust with white hat elements. In the investigation conducted by [Thiel \(2017\)](#), the different core drivers of the Octalysis model were described and associated with the game elements used in various commercial initiatives such as [Hun \(2014\)](#) or NextSuisse [Nextsuisse : au plus près des aspirations de la population \(2015\)](#) and academic projects like *Love Your City* or *NAIST photo*.

3.2. Models for e-government services

Various researchers have proposed a variety of models comprised of different maturity levels, starting from two and up to nine stages. [Reddick \(2004\)](#) introduced a two-stage

model, including (1) a cataloguing stage, where the information is shared with the stakeholders, and (2) a transaction stage, where the citizens can complete forms, interact and complete payments. According to the same author, this is the most common implementation method in the last decades. Both [Mark \(2001\)](#) and the report produced by the [World Bank \(2002\)](#) identified a three-step model where governments (1) publish online information about activities (online presence), while (2) enabling citizens to comment or contact by email on specific open questions (interaction) and (3) offers a platform pay, subscribe and apply for licenses, services and courses (transaction).

[Baum and Di Maio \(2000\)](#) presented a four-stage model including the above-named steps, but adding a new stage called (4) projects and processes that allows governments to modify the structure of the earlier stages (transformation). On the other hand, [Layne and Lee \(2001\)](#) suggest a four-step model where the final stages differ: (1) online presence, (2) transactions (payments, forms...), (3) vertical links that represent hierarchical service connections (federal, local...) and finally, (4) horizontal integration, that interconnects services at the same hierarchical level.

[Andersen and Henriksen \(2006\)](#), with the Public Sector Process Rebuilding (PPR), expanded the previous model by focussing efforts on the IT aspect of each of the stages and reorganised the structure into (1) cultivation (horizontal and vertical integration), (2) extension (publishing), (3) maturity (transactions) and (4) revolution (interaction). [West \(2004\)](#) proposed another four-stage model which includes (1) billboards (online presence), (2) partial service-delivery (interaction with citizens), (3) integration with other services from the particular city or nation into a single platform (horizontal integration) and, finally, (4) interaction with citizens with personalised features.

[Hiller, J. S. & Bélanger \(2001\)](#) devised a five-stage model including: (1) information (online presence), (2) bidirectional communication (interaction), (3) transaction, (4) integration (horizontal across all the services) and, the most important stage, (5) political participation, where online voting and comment submission are enabled. Other authors such as [Moon \(2002\)](#) adopted the previous model to compare and evaluate the data collected by the International City/County Management Association at the 2000 E-government Survey.

[Ronaghan \(2002\)](#) created another five-stage model consisting of the following steps: (1) emerging (online presence), (2) enhanced, (3) interactive, (4) transactions and (5) seamless (horizontal integration). The report produced by [Accenture \(2004\)](#) compiles another five-stage model with similarities to the model in [Andersen and Henriksen \(2006\)](#), where the services and the IT infrastructure are the focal points as well. In this case, two stages are focused on the evolution of the services offered in terms of online-portal options and intranet for cross-agency cooperation.

[Deloitte Consulting \(2000\)](#) introduces a six-stage model which adds an additional step to the model presented by [Accenture \(2004\)](#): portal personalization. This model allows the users to subscribe to notifications from different services, while making the web interface more sophisticated regarding code and infrastructure. [Wescott \(2001\)](#) shows another six-stage model centred in emerging countries, as several of these nations are in the initial implementation phase when it comes to ICT technologies. Instead of considering online presence as the first stage, as most of the previous models do, this

proposal, begins with an essential step: (1) implementing e-mail communications between the different government entities, facilitating communication with the citizens, as well as making transactions via e-mail. The following steps are represented by (2) the interaction and (3) transactions through online and intranet sites. The next step is paramount, and includes (4) transactions, via online databases, with citizens and business, in which payments and office supply services may be automated. The fifth stage is the most important from the citizen's point of view, as it makes available (5) voting mechanisms to be applied in different government processes. The final step represents a mere (6) integration of the range of services in a central site.

In order to provide a better understanding, and to summarise the information compiled in this section, the information has been collected into two tables. Table 1 shows the relationship between models and stages, while Table 2 serves a reference for model comparison, displaying the types of stages included in each model proposal.

TABLE 1
Relation of the models with the different stages.

Model	Stages					
	1	2	3	4	5	6
Reddick	Cataloguing	Transaction				
Mark Howard & World bank	Publish	Interact	Transact			
Gartner	Online presence	Interaction	Transaction	Transformation		
Layne & Lee	Cataloguing	Transaction	Vertical integration	Horizontal integration		
PPR	Cultivation	Extension	Maturity	Revolution		
West	Billboard stage	The partial service delivery	The portal with fully executable & integrated service delivery	Interactive democracy with public outreach & accountability		
Hiller & Blanger	Information dissemination	Two-way communication	Service & financial transformation	Vertical & horizontal	Political participation	
UN	Emerging	Enhanced	Interactive	Transaction	Seamless	
Accenture	Online Presence	Basic capability	Service availability	Mature delivery	Service transformation	
Deloitte	Information publishing	Official two-way transaction	Multipurpose portal	Portal personalization	Clustering of communications	Full integration & Enterprise transformation
Asia pacific	Setting and email system & intranet	Enabling inter-organizational & Public access to information	Allowing 2-way communication	Allowing exchange of value	Digital democracy	Joined up government

TABLE 2
Common stages between models.

Model	Type of stage					
	Online Presence	Interaction	Transaction	Transformation	Integration	Political Participation
Reddick	X		X			
Mark Howard & World bank	X	X	X			
Gartner	X	X	X	X		
Layne & Lee	X		X		X	
PPR	X	X	X		X	
West	X	X	X		X	X
Hiller & Blanger	X	X		X	X	X
UN	X	X	X		X	
Accenture	X	X	X	X		
Deloitte	X	X	X	X	X	
Asia pacific		X	X		X	X

3.2.1. *Maturity level and gamification*

The research conducted by [Al-Yafi and & El-Masri \(2016\)](#) suggests applying gamification to different stages of maturity models to boost citizen participation and overcome some limitations identified by the previous author ([Coronado Escobar and Vasquez Urriago; 2014](#)) and also that current e-government platforms that count with interaction stages are perfect candidates for implementation. To justify this hypothesis, they compile and discuss several successful public and private platforms that include gamification to stimulate user involvement. Finally, they conclude that gamification across stages is essential to contribute to the evolution of the maturity process.

The research carried out by [Wukich and Mergel \(2015\)](#) investigates the maturity level equivalent to the interaction stage in previously described models between government institutions and citizens via the different online presence services like social networks. The authors introduce the topic by discussing the evolution of the government to the stage of online presence and towards bidirectional interaction. Data was collected from different official government actors present on Twitter. The author detected different communication strategies; one-to-many that are the most common one where the government publishes information, one-to-one where a government representative replies to a citizen and also to another institution (horizontal communication), many-to-many where the representative monitors topic's hash tags and other users in order to deny false claims or follow other agencies in case of disasters. Following previous analysis, they investigated the gamification techniques used by these agents, like posting photos of people participating in emergency drills and including a game encouraging citizens to add pictures of their best protection position or place in order to teach about protection measures in case of disaster. They concluded that the agents perceived as most trustworthy were the ones which significantly interacted more with citizens. Concerning the topic of maturity level transformation and political decision-making, Concerning the topic of maturity level transformation and political decision-making, [Opromolla et al. \(2015\)](#) indicate that the attitude towards a bottom-up approach for public administration is increasingly popular. This crowdsourcing strategy requires additional motivation and involvement from citizens to co-design the city (smart city) and its infrastructure in order to suit the population's needs. This shared view, supported by the implementation of gamification elements, turns citizens into active players that can now participate in a game where they can build their own city, the city where they live. The author analysed several real-life smart cities and their applications and found six interaction modes

3.3. *Results report*

The following results were yielded after performing a query with the specified keywords at several academic-paper indexing services. In some cases, the keyword search needed to be expanded in order to refine the results (Google Scholar). The outcome of the first selection process is summarised below.

Google Scholar: 'gamification' AND 'government/e-government' AND 'elements' yielded 994 results. An additional keyword was used in the query to refine the search since Google Scholar filtering is less restrictive than in other engines. A

total amount of 47 documents was selected that included content relevant to the field of study.

Microsoft Academic: 'gamification' AND 'government/e-government' yielded 140 results, 9 articles included the concepts of gamification and e-government and where, therefore, selected; 31 articles were associated only with gamification but were not applied to government services; and 98 items were related to the concept of e-government, but did not include gamification.

CiteSeerX: the keywords 'gamification' AND 'government/e-government' yielded 490 results. Only 5 of them focused on gamification (included game elements) in a government/public service context and were therefore considered for review. The 485 excluded documents were articles that included only gamification or exclusively government/civic issues. A portion of these (17 items) incorporated gamification as a future improvement line/research topic, though it was not the document's main topic.

Sciadirect: 'gamification' AND 'government/e-government' yielded a total number of 464 results. A total of 9 items relevant for this review were considered.

BASE: 'gamification' AND 'government/e-government' yielded 25 results, where 5 items remained for review due to their relevance.

Iopscience: 'gamification' AND 'government/e-government' yielded 1 result, but not deemed relevant to this study.

Arxiv: 'gamification' AND 'government/e-government' yielded 10 results, but none of them related to government services.

To sum up, the keyword search generated more than 2124 articles. The first selection process reduced this number to a total of 75 documents and, after the second selection filter, the number of articles deemed to be useful to fulfil the objectives of the present work was reduced to 8 items.

A set of statistical indicators is indicated below. The first indicator reflects the usage of each models/frameworks within the selected sample. The second indicator corresponds to what type of evaluation method was applied to quantify the gamification impact. Additionally, the present section incorporates a correlation analysis to determine the relationship between the two first indicators and a frequency plot summarising the gamification elements and their prevalence.

The first variable examined is whether the author used a model or framework to implement gamification elements (75 items). As shown in Figure 6 more than a third of the works (42%) did not implement gamification elements following any kind of model/framework. However, the analysis shows that the same proportion of authors (7%) used their own models/proposals and specialised gamification models/frameworks such as MDA, Octalysis, etc. The smallest portion (6%) corresponds to works that followed models that are not focused on gamification applications, or non-gamified

TABLE 3
Reviewed documents and the selection overview.

Source	Stages						
	Google Scholar	Microsoft Academic	CiteSeerX	Sciencedirect	BASE	Arxiv	Iopscience
Total number of results	994	140	490	464	25	10	1
First selection (total)	47	9	5	9	5	0	0
First selection papers)	256 385 124 741 581 191 774 811 281 181 591 1011 51 431 221 781 831 20 711 211 751 211 211 774 801 811 351 888 821 781 401 766 821 577 801 1001 81 410 201 566 881 637 831 557 441 411 91	681 181 51 711 591 111 211 781	111 99 80 17 41	229 751 424 501 177 115 856 116	81 71 211 841 41	NA	NA
Second selection (total)	6	1	1	0	0	0	0
Second selection papers)	166 241 811 121 741 631	111	111	NA	NA	NA	NA

models/frameworks, but a residual amount of cases employed models oriented to the user experience in terms of UI and motivation.

Figure 7 reveals that more than a third of the authors (46%) did not evaluate the results quantitatively (in grey). The percentage of works that assessed the impact of gamification on a single numerical value (usage indicator) such as usage frequency or the number of active users (8%) is notably lower. Some works have applied a more elaborated quantitative evaluation method (7%) to study the evolution of the system after applying gamification elements, thus including a comparison between the gamified and the non-gamified version. Finally, an almost negligible proportion of articles (1%) counts with an in-depth correlation analysis to determine the strength of the relationship between the introduction of gamification elements and the results obtained after application, which is the optimal evaluation method.

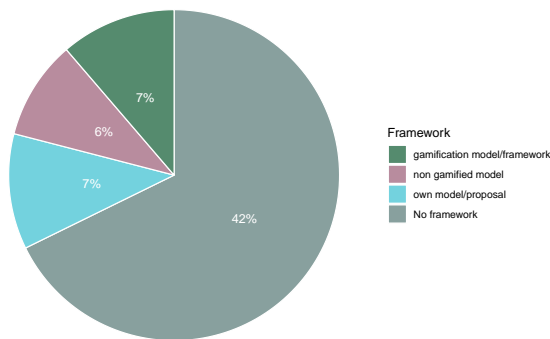


FIGURE 6: Type of model/framework by frequency of use.

In order to determine whether any relationship between the type of model/framework used and the evaluation method employed to evaluate the application of gamification

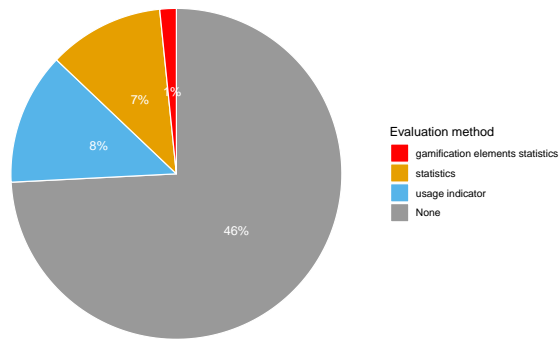


FIGURE 7: Type of evaluation method by frequency of use.

exists, a correlation analysis was carried out. The results are displayed in Figure 8 revealing that, when authors propose their own model, they tend to perform more developed (or complete) statistical analysis (evaluation method) in order to justify the inclusion of each gamification element. However, authors that used gamification models/frameworks tended to lack a robust statistical result evaluation method. This analysis did not reveal any other significant correlation to extract further conclusions.

Finally, in order to determine which gamification elements were most common in the selected literature, a frequency analysis was performed, as displayed in Figure 9. The graph shows that the three most used elements are: points, achievements and badges. Points (scores) are expected to be the most prevalent, since it is considered as the basic or essential element on which other element calculations are based. Points enable the quantification of the user's progress, and thus, without this element it is impossible to establish levels, prizes, leader-boards, and badges.

As additional information, Table 4 condenses the combinations of gamification elements found per item after the first selection phase. Documents without any gamification elements were excluded.

3.4. Review of selected articles

This section compiles real-life examples of applications of gamification elements on e-government platforms as extracted from the sample selected after the second literature filter phase, where only 8 documents were included.

The work carried out by Thiel and Frohlich (2017) presented a participatory public service trial used to improve the city. Although, as a trial, it does not demonstrate the exact type of interaction between the citizen and the administration officers, it shows the types of transactions produced in connection with citizen reports. The prototype provides the possibility to report any issue, such as damage or improvements required in public areas, to the administration. The motivation for applying gamification was low participation. The authors created an interface with and without gamification elements in order to evaluate the impact of gamification in terms of usage. In this study, two groups

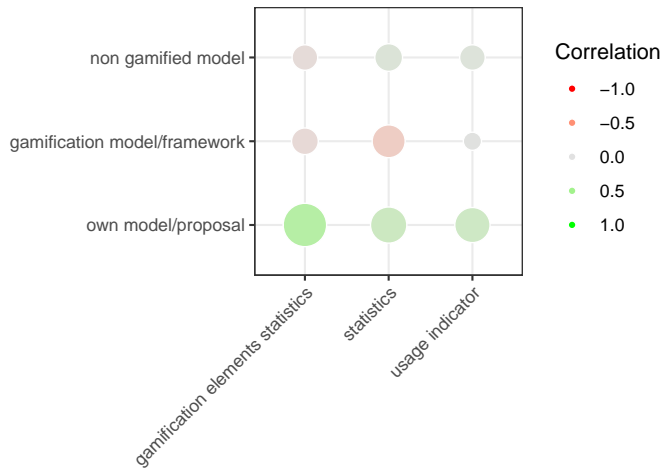


FIGURE 8: Correlation between the type of models/frameworks used and the type of result evaluation method applied.

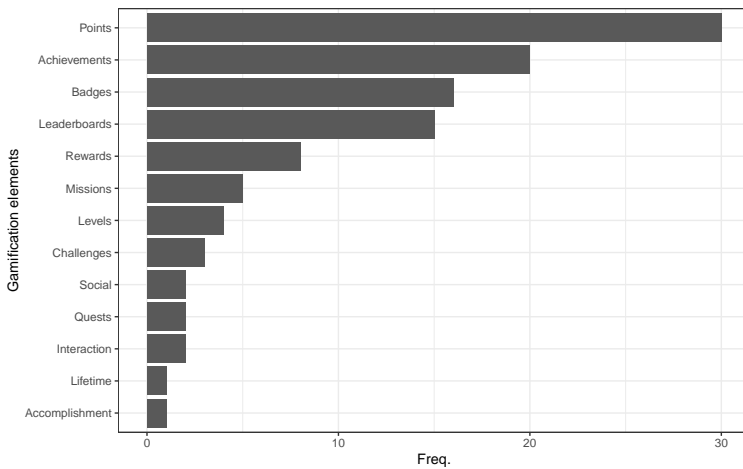


FIGURE 9: Gamification elements by frequency.

TABLE 4

The different combinations of gamification elements found in the literature after phase 1.

Ref #	Badges	Points	Achievements	Accomplishment	Levels	Lifetime	Missions	Leaderboards	Social Interaction	Quests	Challenges	Rewards
42	x	x	x									
74		x	x									
63	x	x		x	x							
81		x				x	x	x	x			
74	x	x			x			x		x		
13	x	x										
101	x	x	x					x				
43			x		x							
53	x	x	x							x		
7	x	x	x					x	x		x	x
71	x	x	x									x
14			x									
67		x										
20	x	x						x				
99		x										
75		x						x				
47		x			x			x				
50			x									x
47		x	x									
15		x	x									x
56	x	x										
16		x									x	
21	x		x									
90		x	x									x
21	x		x									
86		x	x				x					
88		x	x									
40		x						x				
76	x	x						x				
82			x				x					
67												x
80		x					x	x				
100	x											
40								x				
79		x	x				x	x				
68		x										x
66												x
83		x	x					x				
65	x		x					x				
44	x	x						x			x	
6		x										

of volunteers were randomly selected from a sample that received an invitation to participate. Users were encouraged to walk around predefined areas and post aspects that they considered worth sharing. The game elements included in the gamified version were: Lifetime, Missions, Square meter (points assigned based on app activity, influence area feedback), Leaderboard, Profile (user progress vs. other user progress), Emoticons, Social interaction (comments). The authors made a survey among the participants and evaluated their answers using a 5-point Likert scale. According to the results, the version with gamification elements elicits an increase in extrinsic motivation with a reduction in the intrinsic motivation, when compared to the non-gamified version. Additionally, the gamified version had a higher participation.

This work, is a clear of example of the current need for a methodology that determines which gamification elements are appropriate to increase participation in a geo-localised reporting system, since a variety of elements were chosen without establishing an explicit relationship with the objectives to be achieved. For example, with indicators such as the size of the covered area in relation to the number of reports, their level of detail, their frequency, etc. It is possible that these indicators were not included because the study is merely focused on increasing participation. The analysis does not make any causality assessment between the gamification elements implemented and the motivation that they have generated, as extracted from the users' responses to the survey. In this case, any methodological proposal that incorporates a causality analysis for each element, and their result, could be a useful contribution to this field by unveiling which gamification elements were effective.

The research by [Fernandes and Junior \(2016\)](#) integrates gamification on a non-gamified e-government education site for citizens with disabilities and their inclusion at work, which covers different topics, ranging from transport to health and wellbeing at the workplace. There are two versions of the web 2.0 application, one with gamification elements and another without it. The author implements the model defined by [Nepal et al. \(2013\)](#), with the following game mechanics per action: Points, Badges, Level titles (Rookie, Master...), Leaderboard and Quests.

The authors supported their decisions of what gamification elements to choose based on the methods of [Bista et al. \(2012\)](#) and [Ferro et al. \(2013\)](#). This methodological approach is rare, since very few works incorporate such a previous analysis and justification process in relation to the elements selected. After identifying the gamification elements, the authors created a relational table containing score allocations based on the different actions enabled. The main weakness of this study is the result analysis, since it includes few indicators to evaluate the impact of gamification in terms of success for each action.

[Rodrigues, Monteiro, Fernandes, Silva, Analide and Santos \(2019a\)](#) presents a first gamification framework for SmartCities, but as a qualitative proposal and at a superficial level. In this framework, the public officers/administration define the rules of how the gamification points are delivered, what are the objectives, and which are considered as story elements. There is a lack of formal criteria to determine which gamification elements to use and what indicators could be useful to assess the application results of this framework. The same work presents a prototype designed using the proposed framework. This prototype is designed to report events taking place at the SmartCity and to promote tourism. This work lacks the necessary statistical indicators to evaluate the impact of each element of the framework, once again, evidencing the need for a methodology to quantify the effect of gamification elements.

[Bista et al. \(2013\)](#) researched the implementation of gamification elements over an online community for people that are transiting from parental support towards economical emancipation (Next Step). Next Step is an e-government interaction-type e-government service provided by the Australian Department of Human Services. The authors introduce a six-phase process to design gamification elements specifically for this online community. This process is composed of the following stages: (1) identify the gamification contexts, (2) identify potential members' actions, (3) identify point range, (4) establish point assignment rules (allocate points to actions), (5) identify the set of badges) and, finally, (6) determine the rules for badge assignation according to the points earned. This public service has a high maturity level, because it enables transactions between citizens and the management of the service itself. The authors indicate the relationship between the gamification contexts and the possible actions. Only essential gamification elements are included (points and ratings). This proposal does not count with a previous analysis to determine element selection or any post-analysis to evaluate which gamification elements yielded the best results.

The work by [Supendi and Prihatmanto \(2016\)](#) shows the implementation of an e-government service in a developing country (Indonesia). This service enables transactions between the government and the citizens to monitor the level of perceived corruption. In

this case, the service can be considered to represent one of the last stages in the maturity model, since citizen input may influence the government decisions regarding its officers. The gamification implementation is limited to social interactions, including comments and votes. Badges and points are used to motivate user participation. Again, elements are selected without a previous analysis of the users' profile or an individual evaluation of each gamification element. There is also a lack of result evaluation in terms of causality for each element applied and the authors simply conclude that gamification is effective in the context of this crowd-sourcing implementation.

[Rakhmawati and Fibrianto \(2017\)](#) propose another service implementation initiative in Indonesia to gather citizen's proposals regarding any matter. This service is usually found on high maturity level models, because the citizen input influences political decisions concerning the urban environment. To motivate participation through a web portal called Monvis-Musrenbang, the service includes two gamification elements: (1) a reward by points and badges that are received for commenting, sharing and liking posts. These elements were selected without any applied methodology or clear criteria, but merely based on the authors' expectations. The results revealed a 53% increase in participation, with a peak in proposal comments (76%). Consistently with previous works, there is a need for an evaluation methodology to gain a better understanding of the impact of each gamification element rather than a general indicator of success.

The publication of [Blazhko et al. \(2017\)](#) addresses citizen stimulation to understand available open government data (OGD). The objective of this implementation is to teach the citizen about different indicators, such as pollution, death rates, etc. The aim is to improve citizen's information level to encourage and facilitate informed decision-making during elections or other democratic processes like a referendum. To motivate the user, the authors present a gamified version of the OGD interface which includes a ball game and scores. Every time the analysed data (from the interface) changes, the ball changes positions, and the scores are updated based on the statistical plot/histogram. Results indicate that usage and time invested is increased thanks to gamification. Nevertheless, there is also a lack of methodology to justify element selection of further result evaluation.

4. Discussion and Research directions

This review highlights that most works focused on the inclusion of gamification in e-government services does not follow a methodology in order to quantify the impact of the implementation of gamification elements.

After checking the available literature that is closely related to our questions, the present review identifies a set of research gaps that constitute opportunities for future investigators in terms of methodological development and application to assess the implementation of gamification in public services. The development of these methodologies, frameworks or guidelines could have a significant impact on the field. Therefore, the following lines of work are proposed, including the reasoning behind the recommendation:

- **The relation between the citizen/user profile and the gamification element deployed** any study on how the different user profiles react to each type of gamification element applied to public service may become a widely consulted piece of work. So far, gamification element selection depends on the designer's expectations and not on the user profile.
- **Citizen/user response to each gamification element** studies with a robust methodology for a quantitative evaluation of the citizen response towards different gamification elements. Currently, the impact of gamification is generally evaluated and verified through an increase in the usage ratio. Few authors venture to analyse whether the usage is maintained over time or if the increase is due only to novelty.
- **Relationship between the maturity level of the model and the gamification elements used in e-government** to associate a maturity/penetration level of e-government initiatives with the various gamification elements, including their own impact. There have been applications, as this literature review revealed, that include badges or profile icons (classified as social elements) but, at the same time, do not enable any sort of interaction among citizens. Thus, it could be useful to define a methodology in which, for a given type of e-government model, there would be a recommendation of the gamification elements that can be included in order to avoid such implementation contradictions.

5. Conclusions

In this paper, a literature review was performed to investigate the state-of-the-art in the field of gamified e-government services. Before the proper review was conducted, background concepts within the scope of e-government (and the models) and the field of gamification (motivation, framework, etc.) were set. The present paper connects the topic of e-government to gamification through the proposed models, and includes a selection of the different applications, as revealed during the review. As a result of a combined automatic and manual search with a sequential filtering process, 2124 articles were obtained and a total number of 75 works were analysed. Finally, a total amount of 8 examples were reviewed in depth and used to reply to the questions that motivated this work and identify the current research gaps. This review helped identify the common procedure of gamification application to e-government services, highlighting visible methodological gaps.

Three lines of work are proposed: (1) the relation between citizen profile and gamification elements, (2) the expected user response to the gamification element in within e-government services and, finally, (3) the relationship between the maturity level of the model with the gamification element used.

As lines for future work deriving from this systematic review, the authors plan to quantitatively evaluate the frequency of application of each gamification element in relation to a set of indicators (to be determined). These indicators may include user profile analysis, type of model/framework, evaluation method (participation indicators or other performance indicators), etc.

Declarations of Interest

The authors declare no potential conflict of interest.

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