Game elements enabling citizens' engagement: an integrative literature review into elements, motivations, drivers and barriers

Budi Satrio [a*], *Fernando* Kleiman [b], *Marijn* Janssen [c].

[a] Faculty of Technology Policy and Management, Delft University of Technology, Delft, the Netherlands, b.satrio@tudelft.nl, 0000-0001-9291-2039.

[b] Faculty of Technology Policy and Management, Delft University of Technology, Delft, the Netherlands, f.kleiman@tudelft.nl, 0000-0003-3336-3484.

[c] Faculty of Technology Policy and Management, Delft University of Technology, Delft, the Netherlands, m.f.w.h.a.janssen@tudelft.nl, 0000-0001-6211-8790.

Submitted: 31 January 2025, Revised: 26 March 2025, Accepted: 21 April 2025, Published: 21 May 2025

Abstract. Gamification may foster citizen relationships with the government but can also result in a disinterest in participation. In the context of digital government, we do not know which game elements specifically contribute to citizen engagement. In this paper, we conduct an integrative study, drawing from existing literature on citizen engagement through gamification. We examined the citizens' motivation to engage with the government, linked it with game elements explored in the literature, and finally exhibited how these elements could support or inhibit citizens' motivation. Using self-concordance and civic engagement models, we investigated gamification focusing on individual experiences, both personally and as citizens. The findings of this research show a link of static game elements with external and introjected forms of motivation. In contrast, dynamic game elements seem more aligned with intrinsic and identified motivation. We develop a taxonomy outlining these relationships, enabling further research on game elements and their impact on citizen engagement over time.

Keywords. Gamification, Integrative Literature Review, Citizen Engagement, Civic Engagement Theory, Taxonomy, Game Elements, Motivation, Self-Concordance Model, Digital Government.
Research paper, DOI: https://doi.org/10.59490/dgo.2025.974

1. Introduction

Involving citizens in government activities and encouraging their engagement leads to successful collective action (Firmstone & Coleman, 2015; Graham et al., 2019; Kaur et al., 2022). This engagement promotes inclusivity, addresses inequalities, and attracts citizens' interest and opportunities (Arndt et al., 2020; Lopez et al., 2024). However, in the context of digital government, traditional methods such as town hall meetings and public hearings are struggling to engage citizens effectively (Fung, 2015; Irvin & Stansbury, 2004; Kumagai & Ilorio, 2020). The main challenge is making information and opportunities accessible and enjoyable for everyone (Balestrini et al., 2017; Fung, 2015; Purwanto et al., 2020). Digital technologies offer promising solutions to this issue (Firmstone & Coleman, 2015; Geiselhart, 2004; Haro-de-Rosario et al., 2018; Mossberger et al., 2007).

Building on the potential of digital technologies to increase citizen engagement, gamification has emerged as an innovative approach in the digital government context (Van Zoonen, 2020). Gamification has been used to boost citizen participation in activities such as urban planning, public policy feedback, and civic involvement (Hassan & Hamari, 2019; Kazhamiakin et al., 2015; Schrape, 2014). Gamification makes government processes more

interactive and enjoyable, thus increasing engagement (Bianchini et al., 2016; Hassan, 2017; Hassan & Hamari, 2019). However, it also risks shallow engagement and may not sustain long-term involvement (Hassan et al., 2018; Raftopoulos, 2020; Steffens et al., 2017).

Given these factors, it is essential to understand the game elements that make gamification work. For example, the Mechanics, Dynamics, and Aesthetics framework defines a game's mechanics as rules, dynamics as user behavior, and aesthetics as emotional responses (Hunicke et al., 2004). Other definition focuses on motivation, goal completion, and engagement (García Iruela et al., 2019), while another delves into motivation-focused components such as flow, relatedness, purpose, autonomy, and mastery (AlMarshedi et al., 2014). Despite multiple definitions, there remains a notable lack of comprehensive overviews specifically detailing how these elements influence citizen engagement in government activities. This gap is also noted by Resek et al. (2024) and Contreras-Espinosa & Blanco-M (2022). Without a clear understanding of these elements, governments and researchers may struggle to engage citizens effectively using gamification.

This paper bridges the gap by establishing a taxonomy of these elements. We aim to open new avenues for research into citizen engagement and contribute to educational technology by providing insights into how gamification can be effectively applied in civic contexts. Academically, this study contributes to the digital government and participation literature by identifying game elements that influence citizens' engagement in government activities. Practically, it provides insights for governments on using gamification to increase citizen engagement.

In addressing these objectives, we develop a protocol to direct our study. First, we focus on understanding the motivations of citizens to participate in gamified citizens' engagement, both personal and civic motivations. Then, we examine the drivers and barriers that influence their participation. Finally, we explore the game elements that bridge these motivations, drivers, and barriers, providing a comprehensive taxonomy of game elements enabling citizens' engagement.

To present these insights effectively, this study is structured as follows: the research approach, findings, discussion, and conclusions.

2. Research Approach

This paper systematically integrates studies on game elements for citizen engagement using the PRISMA protocol due to its structured and transparent approach (Moher et al., 2009). To complement this approach, we use backwards and forward snowballing (Wohlin, 2014) and materials from Scopus and Web of Science. Then, we discuss the findings with prior studies to reflect on existing knowledge and further contextualize our results within the broader literature.

To guide our study, we formulate three research questions:

RQ1: What motivates citizens to participate in gamified citizen engagement initiatives within digital government?
RQ2: What factors enable or hinder citizen participation in gamified digital government platforms?
RQ3: What are the game elements for gamifying citizen engagement in digital government contexts?

Our search protocol follows the PRISMA phases: identification, screening, eligibility, and inclusion. In the first phase, identification, we use Scopus and Web of Science databases since they are both widely recognized databases for academic literature (Martín-Martín et al., 2018). The search strings in titles and abstracts consist of four sets of keywords: gamification, factors, interaction, and stakeholders, as depicted in Tab. 1. We include "participation" and "engagement" since they are often used interchangeably to describe citizens' involvement. Specific strings in gamification, interaction, and stakeholder sets must exist in the articles' keywords to narrow the search to gamification in government. The publication language is English because studies suggest no evidence of systematic bias in using only English (Jüni et al., 2002; Morrison et al., 2012). We limit the start year of publication to 2010 because it marks the first appearance of the word "gamification" in Google Trends (Google, 2024). During the second phase, screening, we eliminate studies that are not pertinent to the research issue. In the third phase, eligibility, we thoroughly evaluate the remaining research for their relevance and quality. Studies that do not correspond with the research aims are excluded. The rationale for exclusion is recorded to guarantee openness. In the final phase, inclusion, studies that satisfied all inclusion criteria are incorporated into the review. This phase involved a detailed examination of the selected studies to extract relevant data on the gamified citizens' engagement.

Tab. 1 - Search strings used in the title and abstract

Source	Search strings
Scopus	(TITLE-ABS("gami*"OR"game*") AND TITLE-ABS("drive*"OR"motiv*"OR"barrier*"OR"inhibit*") AND TITLE-ABS("engag*"OR"participat*"OR"interact*") AND TITLE-ABS("government*"OR"citizen"OR"people"OR"civic") AND KEY("gami*"OR"game*") AND KEY("engag*"OR"participat*"OR"interact*") AND KEY("government*"OR"citizen"OR"people"OR"civic")) AND PUBYEAR > 2009 AND PUBYEAR < 2025 AND (LIMIT-TO(LANGUAGE,"English"))
Web of Science	((TI=(gami* OR game*)OR AB=(gami* OR game*))AND(TI=(drive* OR motiv* OR barrier* OR inhibit*)OR AB=(drive* OR motiv* OR barrier* OR inhibit*))AND(TI=(engag* OR participat* OR interact*)OR AB=(engag* OR participat* OR interact*))AND(TI=(government* OR citizen OR people OR civic)OR AB=(government* OR citizen OR people OR civic))AND AK=(gami* OR game*)AND AK=(engag* OR participat*)AND AK=(government* OR citizen OR people OR civic))AND PY=(2010-2024)

For the backward search, we include articles authored by similar researchers within the context of gamification in citizen engagement. For the forward search, we include subsequent articles citing the current article that also focused on gamification in citizen engagement. Our inclusion criteria require that the title or abstract addresses gamification in government settings and that the article's content pertains to citizen engagement. Conversely, articles failing to meet these criteria are excluded.

We conducted our search in May 2024. Initially, we found 117 studies: 96 from Scopus and 21 from WoS, resulting in 99 papers after removing duplicates. In the screening, eligibility, and inclusion phases, we included 3 studies from backward and forward searches and excluded 24, totaling 78 studies consisting of conference papers, articles, and book chapters from 2011-2024. Our reason for exclusion is that the study should relate to citizens' engagement. The overall process is outlined in Figure 1.

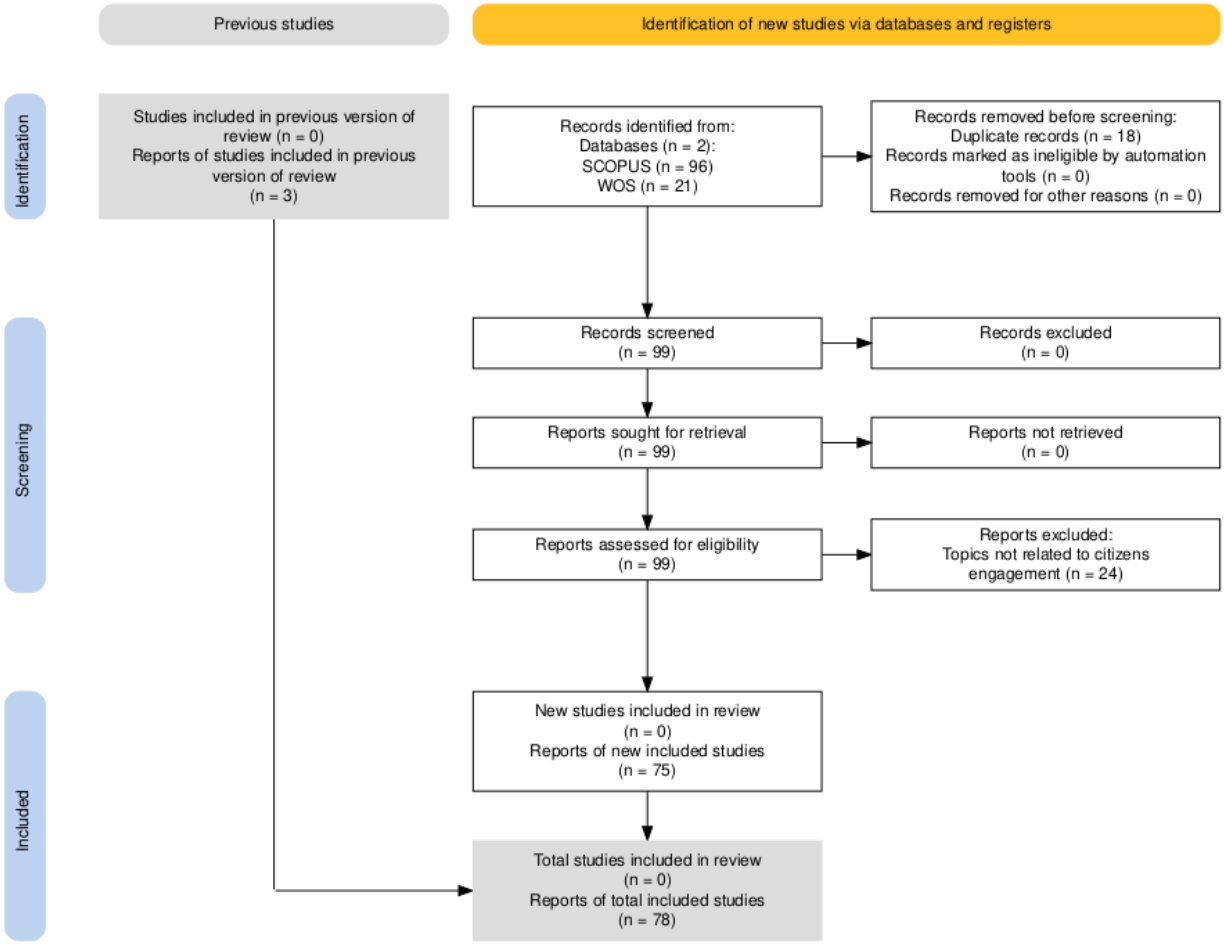

Fig. 1 - PRISMA flow diagram of citizens' motivation, drivers, and barriers of gamified citizens' engagement. This diagram was created using an online PRISMA flow diagram (Haddaway et al., 2022).

3. Findings

This section is structured based on the general findings and the research questions formulated to guide this study. First, we present the bibliometric analysis and notable discoveries. Then, we report the findings on citizens' motivations to engage, which explore individual and civic motivations. Next, we analyze the drivers and barriers of gamification, examining how these aspects influence engagement within civic contexts. Finally, we examine the game elements found in the literature. By organizing the findings in this way, we aim to provide comprehensive information before we discuss their relationship in the next section.

3.1 Bibliometric analysis

In this subsection, we examine the type of publication to understand the distribution across journals, conference papers, and book chapters. Then, we analyze the year of publication to identify the trends of studies in this context. Next, we explore the author's keywords to uncover focus areas within the literature. Finally, we assess the types of games discussed in the papers, providing insights into the specific gamification approaches applied to citizen engagement.

Over 90% of gamification studies in citizen engagement are in conference papers and articles, with few in book chapters. The limited number of studies on gamification in citizen engagement disseminated through book chapters indicates an underutilization of this publication format. This gap suggests an opportunity for researchers to explore the potential of book chapters to provide a more comprehensive analysis and to reach diverse academic audiences.

Examining the year of publication shows growing studies from 2011, a plateau since 2018, and a spike in 2023. This number indicates an ongoing discussion of gamification research since 2018 and a growing interest in recent years. The low number of publications in 2024 may be attributed to ongoing research that has yet to reach publication stages.

We notice the "science" keyword occurs often in the literature search. Further analysis showed that the "science" keyword relates to studies referencing citizen science, where gamification can help the public to contribute to collecting or analyzing the data for research (Haklay et al., 2021). In the assessment of the type of game discussed in the study, we find that 13% of the searched literature discusses evolutionary game theory (EGT), which combines evolutionary biology with game theory (Sigmund & Nowak, 1999). This type of study, funded by Chinese institutions, led to increased research in 2023. Although loosely related to gamification, EGT's focus on stakeholder motivation and interest is similar to gamification's focus, therefore we keep it for further analysis.

3.2 Citizens' motivations

Investigating citizens' motivations reveals why they choose to participate in gamified citizens' engagement. To explore these motivations in depth, we employ the Self-Concordance Model which helps differentiate between individual motivations rooted in personal goals and values, and the Civic Engagement Model which distinguishes civic motivations shaped by resources, psychological engagement, and community.

The Self-Concordance Model classifies motivation into four types: external, introjected, identified, and intrinsic (Sheldon & Elliot, 1999). External motivation, driven by outside factors, includes in-game items like Geo-coins that lead to real-world incentives (Clarke et al., 2017), recognition through scores and badges (Gicquel et al., 2019), or penalties for prolonged silences in recordings (Hantke et al., 2018). Introjected motivation is an internalized form of motivation where goals serve to maintain a certain self-image, such as a sense of ownership for cooperating in Citizen Social Lab (Vicens et al., 2018). Identified motivation occurs when goals are personally significant and driven by personal values, exemplified by users' team preferences in MTV Fantasy Election (Foxman & Forelle, 2014). Intrinsic motivation involves pursuing goals for enjoyment or stimulation as the joy users find in completing OldWeather (Eveleigh et al., 2013) or the immersive experience of Forgotten Island (N. Prestopnik & Souid, 2013). These motivations align with an individual's core values, therefore they are essential for understanding the outcomes of gamification.

The Civic Engagement Model explains citizen participation in government activities through three components: resources, psychological engagement, and recruitment networks (Verba et al., 1995). Resources refer to the necessity for citizens to have spare time, financial means, or skills to participate in gamified citizen engagement. For example, the lack of digital skills among the elderly can hinder their participation in gamification systems (Mendez et al., 2019). Psychological engagement involves the motivation driving citizens to engage psychologically in gamified citizen participation. An example is the narrative element of the Climate4Kids app, where the character Mani helps create an emotional connection, making the topic more relatable and motivating children to take action (Gabriel & Schmölzer, 2022). Recruitment networks refer to the ability of citizens engaged in gamified activities to attract others to join. For instance, citizen involvement in Community Planit led to greater engagement and support

for initiatives (Hassan & Hamari, 2020). These factors reveal potential motivators for citizens and can be used to maintain their engagement.

3.3 Drivers and barriers to citizen participation

We explore the aspect of engagement to see why gamification in civic activities appeals to citizens. Seven driving factors are identified, as outlined in Tab. 2. Five relate to individual motivation: 1) Gamification enhances motivation by making activities enjoyable and rewarding. 2) Autonomy and control give citizens power over the system, boosting engagement. 3) Personalized experiences meet citizens' needs and interests, keeping them engaged. 4) Clear goals and progress provide a sense of transparency and achievement. Finally, 5) Challenges encourage mastery and a sense of completion. The other two are related to social dynamics: 6) A sense of community is created through multiplayer features or leaderboards, encouraging participation. Lastly, 7) competitions ignite motivation for showing skills and long term engagement.

To understand why some gamification failed, we investigate barriers to gamification from its design and external conditions. Ten barriers are identified, four related to design: 1) Focusing too much on extrinsic rewards can reduce engagement. 2) Intense competition and rewards may dampen intrinsic motivation. 3) Poor user interface leads to difficulty in participating effectively. Lastly, 4) Poor gamification mechanisms can reduce engagement. The other six barriers are related to external factors: 5) Skepticism leads to distrust and difficulty in attracting users. 6) Economic barriers may prevent low-income participation. 7) Socio-cultural factors can hinder engagement in specific demographics. 8) Privacy concerns can deter participation if not handled correctly. 9) Limited feedback or support makes citizens refrain from gamification. Finally, 10) technology overload can overwhelm and disengage citizens.

More studies report on the drivers of gamification than on its barriers. This suggests researchers focus more on the positive outcomes than the drawbacks. These differences show the current state of gamification research and highlight the need for future studies to examine both aspects.

Tab. 2 - Drivers and barriers to citizens' participation with detailed information in Appendix A and B (in supplemental material)

Drivers	Number of studies	Barriers	Number of studies
Enhancing personal motivation	52	Overemphasis on external rewards	5
Autonomy and control	10	Dampened intrinsic motivation	1
Personalized experiences	7	Poor user interface	1
Transparent goals and progress	19	Poor gamification mechanism	2
Sense of community	23	Skepticism	4
Challenges	17	Economic barriers	1
Competitions	27	Socio-cultural factors	1
		Privacy concerns	3
		Limited feedback or support	1
		Technology barriers	4

3.4 Game elements in the literature

The literature provides examples of different types of games, namely serious games, commercial games, and gamification. Serious games are designed for educational purposes or to change behavior, not just for entertainment, focusing on user experience and achieving real-world outcomes (Abt, 1975; Michael & Chen, 2011). Commercial games, by contrast, aim purely to entertain, concentrating on engaging gameplay, graphics, and storytelling to generate profit (Wolf, 2002). Gamification applies game elements to non-gaming contexts to increase engagement (Deterding et al., 2011). Although these categories differ in purpose, they all share the common use of game elements to achieve their objectives.

To better identify these game elements, we classify them into static and dynamic, as outlined in Tab. 3. Static elements are predefined components such as features or metrics. Dynamic elements are the processes that interact with static elements. For example, points and ranks are static, while the difficulty of earning those points and ranks is dynamic.

Tab. 3 – The game elements with detailed information in Appendix C and D (in supplemental material)

Static Elements	Number of studies	Dynamic Elements	Number of studies
Points/Scores	37	Progress	22
Badges/Achievements	21	Aesthetics	4
Leaderboards	27	Ease of use	2
Levels/Ranks	21	Challenges/Difficulties	13
Rewards/Bonuses/Prizes	30	Rarity	3
Punishments/Penalties	12	Competition/Cooperation	24
Avatars	5	Narrative/Themes/Plots/Story	17
Virtual Goods/Collections	3	Feedback	27
Virtual currencies	3	Discovery	2
Tutorials	2	Social Interaction	19

Further delving into the static and dynamic elements, we explore each element and then connect each to the motivation, drivers, and barriers as reported or implied in the literature. We summarize our findings of static game elements in Tab. 4 and the findings of dynamic game elements in Tab. 5.

Tab. 4 – Taxonomy of static game elements

Game Elements	Individual Motivation	Citizen Motivation	Drivers	Barriers
Points/Scores	External	Resources	Enhancing motivation	Overemphasis on extrinsic rewards
Badges/Achievements	• External • Introjected	• Resources • Recruitment Networks	• Enhancing motivation • Personalized experiences	• Overemphasis on extrinsic rewards • Poor UI • Poor mechanism
Leaderboards	• External • Introjected	• Resources • Recruitment Networks	• Enhancing motivation • Challenges • Competitions	• Overemphasis on extrinsic rewards • Privacy concerns
Levels/Ranks	• External • Introjected	Resources	Enhancing motivation	Overemphasis on extrinsic rewards
Rewards/Bonuses/Prizes	External	• Resources • Psychological Engagement • Recruitment Networks	Enhancing motivation	• Overemphasis on extrinsic rewards • Poor mechanism
Punishments/Penalties	External	• Psychological Engagement • Recruitment Networks	• Enhancing motivation • Challenges	Overemphasis on extrinsic rewards
Avatars	Introjected	Psychological Engagement	Personalized experiences	Poor UI
Virtual Goods/Collections	External	• Resources • Recruitment Networks	• Enhancing motivation • Personalized experience	• Overemphasis on extrinsic rewards • Poor mechanism
Virtual currencies	External	• Resources • Psychological Engagement	Enhancing motivation	Overemphasis on extrinsic rewards
Tutorials	External	Resources	Autonomy or control	• Poor UI • Skepticism

Points or scores are widely used to measure users based on actions, serving as motivational tools for rewards and engagement (Hassan, 2017). For example, users might use mobile esports to compete, win, or even earn monetary

rewards, indicating that investing skills and time are required for participation (Hassan & Hamari, 2020; Vanolo, 2019). While points can boost engagement, relying too much on them without other rewards risks losing participation over time (Foxman & Forelle, 2014; Hassan & Hamari, 2020; Peischl et al., 2014; N. R. Prestopnik & Tang, 2015; Resek et al., 2024).

Badges or achievements indicate that users have met a game's objectives (Hassan, 2017). They seem to influence external motivation and drive introjected motivation, serving as proof of success and encouraging other users' participation (Bhéreur-Lagounaris, 2016; Bowser et al., 2014; Clarke et al., 2017; Gabriel & Schmölzer, 2022; Gastil & Broghammer, 2021; Gicquel et al., 2019; Hantke et al., 2018; Iacovides et al., 2013; Mendez et al., 2019; Peischl et al., 2014; Rehm et al., 2018; Sergeyeva et al., 2020). However, obtaining them requires citizens to invest time, money, or skills (Becker et al., 2019; Clarke et al., 2017; Dargan & Evequoz, 2015; De Francisco et al., 2024; Gastil, 2023; Gastil & Broghammer, 2021; Hantke et al., 2018; Mendez et al., 2019). Badges can boost engagement and offer personalized experiences, however, overemphasizing their extrinsic rewards and their poor user interface or gamification mechanism may disengage users (Dargan & Evequoz, 2015; Mendez et al., 2019).

Leaderboards rank users based on their points or achievements (Hassan, 2017). Similar to badges, leaderboards seem to provide external motivation and can be proof of success to others, but acquiring them requires an investment of resources (Bousios et al., 2017; Hassan & Hamari, 2020; Torres-Toukoumidis et al., 2017). Although leaderboards increase motivation and offer challenges or competitions, excessive rewards and privacy concerns may deter engagement (Foxman & Forelle, 2014; Gastil, 2023; Hassan, 2017; Hassan & Hamari, 2020; Moreira et al., 2020; Peischl et al., 2014; Torres-Toukoumidis et al., 2017; Vanolo, 2019).

Levels or ranks show a user's progression or challenges in a game, such as in "Papers, Please," which uses days as levels (Pflanzl et al., 2017). Levels seem to affect external and introjected motivation, but they need an investment of time, cost, or skills (Avolicino et al., 2022; Bousios et al., 2017; Fernandes & Junior, 2016; Hantke et al., 2018; Padilla-Zea et al., 2022; Torres-Toukoumidis et al., 2017). Although levels enhance motivation, excessive rewards might disengage users (Eveleigh et al., 2013; Gicquel et al., 2019; Palacin-Silva et al., 2018; Thiel, 2015; Thiel et al., 2016).

Rewards, bonuses, or prizes are given to users for completing game challenges and can be virtual or real-world rewards, such as currency or other in-game benefits, as seen in Forgotten Island (N. R. Prestopnik & Tang, 2015). Rewards seem to be linked to external motivation and can influence psychological engagement, as well as encourage others to join, but they need resources to invest (Bhéreur-Lagounaris, 2016; Lee et al., 2017; Schell & Kaufman, 2016; Wilis & Parningotan Manik, 2022). However, poorly designed and too much focus on extrinsic rewards can hinder engagement (Bu et al., 2023; Clarke et al., 2017; Foxman & Forelle, 2014; Hassan & Hamari, 2020; Thiel & Lehner, 2015).

Unlike rewards, **punishments or penalties** impose negative consequences on users who do not meet objectives. For example, penalties in evolutionary game theory promote green innovation and enforce driving regulations (Sun et al., 2023; Wang et al., 2021). They seem to motivate psychologically and encourage others to join, but they require an investment of resources (Sun et al., 2023). Punishments present challenges, but excessive rewards from punishments may deter engagement (Li et al., 2023).

Avatars, visual representations of users, provide a sense of presence or personality within a game, such as avatars in EcoGo (Avolicino et al., 2022). Avatars can serve as proof of success and seem to provide psychological motivation (Avolicino et al., 2022; Resek et al., 2024; Thiel et al., 2016). They also provide a personalized experience, but poor interface may deter engagement (Thiel et al., 2016).

Virtual goods or collections, such as collectables in the iHEARu-PLAY game and in-game pets (Clarke et al., 2017; Hantke et al., 2018)(Clarke et al., 2017; Hantke et al., 2018), seem to be linked to external motivations and encourage the participation of others. However, they require an investment of resources (N. R. Prestopnik & Crowston, 2011). Virtual goods enhance the personalized experience, but excessive use and poor mechanisms may deter engagement (Clarke et al., 2017).

Virtual currency, such as GeoCoins or eco-points (Avolicino et al., 2022; Clarke et al., 2017), acts as in-game money to facilitate actions in the game. Virtual currency seems to tap external motivation and provide psychological motivation, but it requires an investment of resources (Clarke et al., 2017; Hantke et al., 2018; N. Prestopnik & Souid, 2013), and excessive use of it may disengage users (De Francisco et al., 2024).

Tutorials help users understand what they must do in a game, making it more approachable. They familiarize users with game mechanics, requiring an investment of time and skills, such as in The Climate Game or the Climate4Kids game (Torres-Toukoumidis et al., 2017; Vicens et al., 2018). Tutorials seem to provide a sense of autonomy and control, but a poor interface and skepticism can deter engagement (Schell & Kaufman, 2016; Torres-Toukoumidis et al., 2017).

Tab. 5 – Taxonomy of dynamic game elements

Game Elements	Individual Motivation	Citizen Motivation	Drivers	Barriers
Progress	Identified	• Resources • Psychological Engagement	• Autonomy or control • Clear goals or progress	• Poor UI • Poor mechanism
Aesthetics	Intrinsic	Psychological Engagement	• Enhancing motivation • Personalized experiences	• Socio-cultural factors • Technology overload • Poor UI
Ease of use	Intrinsic	Psychological Engagement	• Enhancing motivation • Personalized experiences	• Technology overload • Poor UI
Challenges/Difficulties	Intrinsic	• Resources • Psychological Engagement	Challenges	• Poor mechanism • Dampened intrinsic motivation
Rarity	Intrinsic	• Resources • Psychological Engagement • Recruitment Networks	• Enhancing motivation • Challenges	Dampened intrinsic motivation
Competition/Cooperation	• External • Introjected	• Resources • Psychological Engagement • Recruitment Networks	Competitions	• Poor mechanism • Skepticism
Narrative/Themes/Plots/ Story	Identified	• Psychological Engagement • Recruitment Networks	• Clear goals and progress • Personalized experiences	• Socio-cultural factors • Skepticism
Feedback	Identified	Psychological Engagement	• Enhancing motivation • Autonomy and control	• Limited feedback or support • Skepticism • Poor mechanism
Discovery	Intrinsic	• Resources • Psychological Engagement	• Autonomy and control • Personalized experiences	• Poor mechanism • Skepticism
Social Interaction	• Intrinsic • Identified	• Resources • Psychological Engagement • Recruitment Networks	• Enhancing motivation • Sense of community • Personalized experiences	• Privacy concerns • Socio-cultural factors • Poor mechanism

Progress tracks objectives achieved by users. For example, progress bars are used to break tasks into smaller goals, as seen in eCH-BPM Switzerland's approach (Dargan & Evequoz, 2015; Vanolo, 2019). Progress, motivated by personal value to finish the task, seems to be psychologically engaging but requires an investment of resources (Becker et al., 2019; N. Prestopnik & Souid, 2013). Citizens have autonomy and control over progress, but a poor UI or mechanism can deter engagement (Hassan & Nader, 2016; Moreira et al., 2020; Rehm et al., 2018).

Aesthetics, including visuals and sounds, influence a game's atmosphere and user engagement (De Francisco et al., 2024; Romero-Hernandez et al., 2018). They seem to provide intrinsic motivation and personal enjoyment, fostering psychological engagement (Clarke et al., 2017; Latifi et al., 2022). However, socio-cultural differences, technological limitations, and poor interface seem to deter participation (Hassan & Nader, 2016; Pflanzl et al., 2017; Quecke & Mariani, 2021).

Ease of use in gaming means features that simplify gameplay, such as user-friendly interfaces for the elderly, children, or people with (Bousios et al., 2017; Mendez et al., 2019; Schell & Kaufman, 2016). It links to intrinsic

motivation and psychological engagement (Minge et al., 2014; Schell & Kaufman, 2016). This game element personalizes the experience, but technological overload and a poor UI can deter engagement (Mendez et al., 2019; N. R. Prestopnik & Crowston, 2011; Redondo, Giménez, Navarro, & Fonseca, 2020; Schell & Kaufman, 2016; Vicens et al., 2018).

Challenges or difficulties in games make users overcome obstacles to reach goals. They provide intrinsic and psychological motivation but require an investment of time, money, or skills (Bhéreur-Lagounaris, 2016; Pflanzl et al., 2017; N. R. Prestopnik & Tang, 2015; Torres-Toukoumidis et al., 2017; Wilis & Parningotan Manik, 2022). Although the challenge element drives gamification, a poor challenge mechanism can deter engagement (Chian, 2023; Eveleigh et al., 2013; Hantke et al., 2018; Kongeseri & Coley, 2019; Minge et al., 2014; N. R. Prestopnik & Tang, 2015; Thiel & Lehner, 2015).

Rarity in games refers to the scarcity of items, which creates a sense of achievement when obtained. This element seems to provide intrinsic and psychological motivation and encourages others to join, but it requires an investment of resources (Clarke et al., 2017). Although driven by challenges similar to rewards, an excess of rarity may dampen intrinsic motivation (Dargan & Evequoz, 2015).

Competition or cooperation among users is linked to external motivation, as it can demonstrate success and encourage others to join. However, it requires resources to play (Dargan & Evequoz, 2015; Foxman & Forelle, 2014; Hassan & Hamari, 2020; Iacovides et al., 2013; Palacin-Silva et al., 2018; Resek et al., 2024; Thiel & Lehner, 2015; Wilis & Parningotan Manik, 2022). Poor competition or cooperation mechanisms and skepticism about them may reduce engagement (Bossavit & Parsons, 2016; Bousios et al., 2017; Eveleigh et al., 2013; Foxman & Forelle, 2014; Hassan & Hamari, 2020; Palacin-Silva et al., 2018; Thiel et al., 2016; Wilis & Parningotan Manik, 2022).

Narratives, themes, plots, or story provide context and emotion, guiding user actions, and connecting with personal values and psychological engagement (Clarke et al., 2017; Eveleigh et al., 2013; Gabriel & Schmölzer, 2022; Gastil & Broghammer, 2021; Kongeseri & Coley, 2019; Padilla-Zea et al., 2022; N. R. Prestopnik & Crowston, 2011; N. R. Prestopnik & Tang, 2015; Ronzhyn et al., 2020; Tennent et al., 2016; Vicens et al., 2018). They seem to give personalized experiences and clear goals for citizens. However, sociocultural factors and skepticism in narratives can deter engagement (Foxman & Forelle, 2014; Kongeseri & Coley, 2019; Padilla-Zea et al., 2022; Quecke & Mariani, 2021).

Feedback helps to assess user actions and can motivate them by aligning with personal values (Avolicino et al., 2022; Bhéreur-Lagounaris, 2016; De Francisco et al., 2024; Gastil & Broghammer, 2021; Peischl et al., 2014). Feedback seems to provide autonomy and control to citizens. However, limited support, skepticism, and poor mechanisms can reduce engagement (Palacin-Silva et al., 2018; Thiel & Lehner, 2015).

Discovery motivates users to explore new aspects of a game. It seems to be driven by intrinsic motivation and psychological engagement, but it needs resources to interact (Pflanzl et al., 2017). Discovery provides personalized experience and autonomy or control to interact. However, skepticism and poor mechanisms seem to lower participation (Foxman & Forelle, 2014).

Social interactions engage users with each other beyond cooperation or competition. It seems to be driven by intrinsic motivation and aligns more with personal values to communicate, foster psychological engagement, and encourage participation, however, it requires an investment of resources (Bhéreur-Lagounaris, 2016; Iacovides et al., 2013; Palacin-Silva et al., 2018). Social interaction gives a sense of community and personalized experience. However, privacy concerns, socio-cultural issues, and poor interaction mechanisms seem to deter engagement (Palacin-Silva et al., 2018).

During our analysis, we noticed the ambiguities of the game elements, such as one element can target different kinds of motivations. To clarify these ambiguities, we examine their similarities, subsets, and broader specifics. For instance, 'Competition/Cooperation' relates to external and introjected motivation but can also be intrinsic. For example, competing or cooperating for rewards without comparing to others tends toward external motivation, while competing or cooperating to seek recognition tends toward introjected motivation. However, competing or cooperating purely for enjoyment falls under 'Challenges/Difficulties' or 'Social Interaction' and is intrinsic. We specify the motivational context for each element to address its complexity.

4. Discussion

Various studies have explored the link between game elements and different factors by proposing classifications (Hassan & Hamari, 2020; Resek et al., 2024; Thiel & Lehner, 2015). This paper continues in the same direction by focusing on linking game elements with personal and civic motivations as well as the drivers and barriers to citizen engagement. However, the connection between these game elements can be unclear. Therefore, this study narrows its analysis to individual game elements rather than the entirety of gamification. For instance, while an economic

barrier might affect overall gamification, it may not impact individual game elements. The objective is to simplify understanding the relationship between motivations and influencing factors while acknowledging the need for empirical evidence.

In our findings, we notice that static elements mainly target external or introjected motivations and require time, money, or skills. This suggests that while these elements can incentivize engagement, individuals may need to invest to participate. Further delving into the engagement, a preliminary study suggested that static game elements, such as badges and leaderboards, can effectively stimulate external motivation and foster initial engagement (Steffens et al., 2017). Therefore, by leveraging static elements, it becomes possible to jumpstart initial involvement, laying the groundwork for subsequent engagement. However, overemphasizing extrinsic rewards on these static elements can hinder engagement. This argument is backed up by Thiel & Lehner's (2015) research that indicates citizens tend to find game elements monotonous over time.

On the other hand, our findings indicate that the dynamic elements are hypothetically linked to intrinsic and identified personal motivation, except for competition and cooperation, which align more closely with external and introjected motivation. The Civic Engagement Model highlights psychological engagement as a crucial factor across all dynamic elements for maintaining emotional involvement. On a similar note, Huang et al. (2024) underscores the importance of intrinsic motivation in cultivating long-term engagement. This argument emphasizes that incorporating dynamic elements into gamified systems can foster deeper motivational connections, which are crucial for supporting long-term participation, especially in situations that require sustained engagement. We also note that socio-cultural factors emerged in dynamic rather than static elements, underscoring the importance of considering the socio-cultural context when implementing these dynamic elements.

Recognizing that static and dynamic game elements target different types of motivation is important to understanding their role in fostering engagement. Static elements relate to external and introjected motivation, making them effective for jumpstarting engagement by providing an external incentive to participate. In contrast, dynamic elements are more aligned with intrinsic and identified motivation, sustaining engagement over time by fostering a deeper emotional and psychological connection. Previous studies emphasize that external motivation is useful for starting engagement, while intrinsic motivation can maintain long-term involvement (Huang et al., 2024; Steffens et al., 2017). We suggest combining these static and dynamic game elements to encourage initial participation and sustain engagement over time.

5. Conclusions

In the realm of digital government, engaging citizens is key to generating benefits for both governments and citizens. Gamification, which uses game elements in digital government initiatives, has been explored to increase this engagement. Our literature review reveals how game elements influence citizens' motivation to participate and identifies the factors that facilitate or hinder engagement.

For our first research question on citizens' motivation, we employed the Self-Concordance Model to categorize individual motivations and utilized the Civic Engagement Model to explain civic motivations. In addressing the second question on drivers and barriers, we identified seven drivers that enhance motivation and ten barriers that impede it. For the third question on game elements, we examined the literature and linked game elements to personal and civic motivations, drivers, and barriers, as outlined in Section 3.

Our findings suggest that static game elements such as Points, Badges, and Avatars are hypothetically associated with external and introjected motivation. In contrast, dynamic elements such as Progress and Aesthetics are hypothetically related to intrinsic and identified motivation, whereas Competition/Cooperation is more aligned with external and introjected motivation. We discuss that static game elements can jump-start engagement, and dynamic game elements can sustain engagement over time. We suggest a combination of static and dynamic elements as a balanced approach to designing gamified systems, ensuring both initial participation and long-term engagement.

5.1 Limitations

We acknowledge several limitations in this research. First, the studies we reviewed were selected according to the PRISMA, which might introduce biases in study selection. The biases include the exclusion of non-English articles, reliance on Scopus and Web of Science as primary databases, and the potential oversight of some relevant studies. Second, our research specifically examines gamification in citizen engagement and may not be generalizable to other fields. Third, our discussion linking game elements to citizens' motivations and influencing factors is based on both explicit and implicit relationships in the literature, which could introduce reporting bias. Lastly, while we recognize the challenges in practical applications, such as ethical concerns, our taxonomy lacks empirical validation. Thus, the conclusions remain theoretical.

5.2 Future research

Game elements can drive meaningful engagement over time by aligning with citizens' motivations. Our proposed taxonomy facilitates the distinction between different types of game elements and offers a new avenue for studying their impacts on citizens' activities. Future research should investigate the effectiveness of these game elements in increasing citizen engagement. Additionally, researchers should incorporate studies from a wider array of sources and in multiple languages. Furthermore, empirical validation of this taxonomy is necessary, with future studies supporting it through case studies.

Acknowledgement

We thank the reviewers for their valuable guidance during the revision process and our colleagues for their valuable suggestions during the conduct of this study.

Funding or Grant

This work presented herein was funded by the Indonesia Endowment Fund for Education (LPDP) grant number: 202308221741246.

Data/Software Access Statement

Supplemental materials of the selected studies are available through https://doi.org/10.4121/0e098400-604e-4908-8155-b51ebef71c97.

Contributor Statement

Budi Satrio: Writing – original draft, Formal analysis. Fernando Kleiman: Writing – review & editing, Supervision, Conceptualization. Marijn Janssen: Writing – review & editing, Supervision.

Use of AI

During the preparation of this work, the author(s) used Rewrite/Copilot in order to improve readability. After using this tool/service, the author(s) reviewed, edited, made the content their own and validated the outcome as needed, and take(s) full responsibility for the content of the publication.

Conflict of Interest (COI)

Budi Satrio reports financial support was provided by the Indonesia Endowment Fund for Education (LPDP) grant no: 202308221741246. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Abt, C. C. (1975). *Serious games* (5. print). Viking Press.

AlMarshedi, A., Wills, G. B., Wanick, V., & Ranchhod, A. (2014). Towards a sustainable gamification impact. *International Conference on Information Society (i-Society 2014)*, 195–200.

Arndt, E., Burgman, M., Schneider, K., & Robinson, A. (2020). Working with government–innovative approaches to evidence-based policy-making. *Conservation Research, Policy and Practice*, 216–229.

Avolicino, S., Di Gregorio, M., Romano, M., Sebillo, M., Tortora, G., & Vitiello, G. (2022). EcoGO: Combining eco-feedback and gamification to improve the sustainability of driving style. *Proceedings of the 2022 International Conference on Advanced Visual Interfaces*, 1–5. https://doi.org/10.1145/3531073.3531127

Balestrini, M., Rogers, Y., Hassan, C., Creus, J., King, M., & Marshall, P. (2017). A city in common: A framework to orchestrate large-scale citizen engagement around urban issues. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, 2282–2294.

Becker, M., Ksenia Koroleva, Diogo Vitorino, K. D., & Novak, J. (2019). Developing a Collective Awareness Platform for Urban Sustainability Challenges: Case Study of the POWER Project. *European Journal of Sustainable Development*, *8*(4), 214. https://doi.org/10.14207/ejsd.2019.v8n4p214

Bhéreur-Lagounaris, A. (2016). Is Citizen Science Gaming the Next 'Level Up' for Social Impact Games? Crossing Public Involvement, Technological Accessibility and Game Design. In B. Kuhn (Ed.), *Levelling Up: The Cultural Impact of Contemporary Videogames* (pp. 111–120). BRILL. https://doi.org/10.1163/9781848884380_013

Bianchini, D., Fogli, D., & Ragazzi, D. (2016). Promoting citizen participation through gamification. *Proceedings of the 9th Nordic Conference on Human-Computer Interaction*, 1–4.

Bossavit, B., & Parsons, S. (2016). Designing an educational game for and with teenagers with high functioning autism. *Proceedings of the 14th Participatory Design Conference: Full Papers - Volume 1*, 11–20. https://doi.org/10.1145/2940299.2940313
Bousios, A., Gavalas, D., & Lambrinos, L. (2017). CityCare: Crowdsourcing daily life issue reports in smart cities. *2017 IEEE Symposium on Computers and Communications (ISCC)*, 266–271. https://doi.org/10.1109/ISCC.2017.8024540
Bowser, A., Hansen, D., Preece, J., He, Y., Boston, C., & Hammock, J. (2014). Gamifying citizen science: A study of two user groups. *Proceedings of the Companion Publication of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*, 137–140. https://doi.org/10.1145/2556420.2556502
Bu, Z., Liu, J., & Zhang, X. (2023). Collaborative government-public efforts in driving green technology innovation for environmental governance in PPP projects: A study based on prospect theory. *Kybernetes*. https://doi.org/10.1108/K-08-2023-1415
Chian, Y. X. (2023). Sustainable, inclusive city-making through smart, playable environments: Developing and testing the CO2rdinates pervasive mobile game. *26th International Academic Mindtrek Conference*, 321–328. https://doi.org/10.1145/3616961.3617803
Clarke, S., Arnab, S., Lewis, M., Morini, L., Depriori, S., Bogliolo, A., & Klopfenstein, L. (2017). A gamified approach for facilitating a user-engagement strategy for public-led collective awareness platform for road sensing. *Proceedings of the 11th European Conference on Games Based Learning, ECGBL 2017*, 79–87.
Contreras-Espinosa, R. S., & Blanco-M, A. (2022). A Literature Review of E-government Services with Gamification Elements. *International Journal of Public Administration*, *45*(13), 964–980. https://doi.org/10.1080/01900692.2021.1930042
Dargan, T., & Evequoz, F. (2015). Designing Engaging e-Government Services by Combining User-Centered Design and Gamification: A Use-Case. *Proceedings of the European Conference on E-Government, ECEG*, *2015-January*, 70–78.
De Francisco, M. S., Díaz, P., Onorati, T., Monteron, Á., & Aedo, I. (2024). Designing mobile technologies to encourage civic engagement: The role of situated motivational affordances. *IEEE Transactions on Emerging Topics in Computing*, 1–12. https://doi.org/10.1109/TETC.2023.3296772
Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification." *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9–15. https://doi.org/10.1145/2181037.2181040
Eveleigh, A., Jennett, C., Lynn, S., & Cox, A. L. (2013). "I want to be a captain! I want to be a captain!": Gamification in the *old weather* citizen science project. *Proceedings of the First International Conference on Gameful Design, Research, and Applications*, 79–82. https://doi.org/10.1145/2583008.2583019
Fernandes, F. T., & Junior, P. T. A. (2016). Gamification Aspects in the Context of Electronic Government and Education: A Case Study. In F. F.-H. Nah & C.-H. Tan (Eds.), *HCI in Business, Government, and Organizations: Information Systems* (Vol. 9752, pp. 140–150). Springer International Publishing. https://doi.org/10.1007/978-3-319-39399-5_14
Firmstone, J., & Coleman, S. (2015). Public engagement in local government: The voice and influence of citizens in online communicative spaces. *Information, Communication & Society*, *18*(6), 680–695.
Foxman, M., & Forelle, M. (2014). Electing to Play: MTV's Fantasy Election and Changes in Political Engagement Through Gameplay. *Games and Culture*, *9*(6), 454–467. https://doi.org/10.1177/1555412014549804
Fung, A. (2015). Putting the public back into governance: The challenges of citizen participation and its future. *Public Administration Review*, *75*(4), 513–522.
Gabriel, S., & Schmölzer, B. (2022). Climate4Kids: A Gamified App Teaching about Climate Change. *Proceedings of the European Conference on Games-Based Learning*, *16*, 236–243.
García Iruela, M., Fonseca, M. J., Hijón Neira, R., & Chambel, T. (2019). Analysis of gamification elements. A case study in a computer science course. *Artificial Intelligence in Education: 20th International Conference, AIED 2019, Chicago, IL, USA, June 25-29, 2019, Proceedings, Part II 20*, 89–93.
Gastil, J. (2023). To Play Is the Thing: How Game Design Principles Can Make Online Deliberation Compelling. *American Behavioral Scientist*, *67*(8), 1042–1060. https://doi.org/10.1177/00027642221093592
Gastil, J., & Broghammer, M. (2021). Linking Theories of Motivation, Game Mechanics, and Public Deliberation to Design an Online System for Participatory Budgeting. *Political Studies*, *69*(1), 7–25. https://doi.org/10.1177/0032321719890815
Geiselhart, K. (2004). Citizen engagement: The next horizon for digital government.[Paper in: The Vocal Citizen, Patmore, Glenn and Jungwirth, Gary (eds.).]. *Labor Essays*, *2004*, 86–99.
Gicquel, P.-Y., Hamon, L., Plaut, F., & George, S. (2019). Albiziapp: A Gamified Tool Dedicated to Tree Mapping. In A. Liapis, G. N. Yannakakis, M. Gentile, & M. Ninaus (Eds.), *Games and Learning Alliance* (Vol. 11899, pp. 287–297). Springer International Publishing. https://doi.org/10.1007/978-3-030-34350-7_28
Google. (2024). *Gamification on google trends*. Google Trend. https://trends.google.com/trends/explore?date=all&q=gamification
Graham, S., Metcalf, A. L., Gill, N., Niemiec, R., Moreno, C., Bach, T., Ikutegbe, V., Hallstrom, L., Ma, Z., & Lubeck, A. (2019). Opportunities for better use of collective action theory in research and governance for invasive species management. *Conservation Biology*, *33*(2), 275–287.
Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). *PRISMA2020*: An R package and Shiny

app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis. *Campbell Systematic Reviews*, *18*(2), e1230. https://doi.org/10.1002/cl2.1230

Haklay, M., Dörler, D., Heigl, F., Manzoni, M., Hecker, S., Vohland, K., Vohland, K., Land-Zandstra, A., Ceccaroni, L., Lemmens, R., & others. (2021). What is citizen science? The challenges of definition. *The Science of Citizen Science*, *13*.

Hantke, S., Appel, T., & Schuller, B. (2018). The Inclusion of Gamification Solutions to Enhance User Enjoyment on Crowdsourcing Platforms. *2018 First Asian Conference on Affective Computing and Intelligent Interaction (ACII Asia)*, 1–6. https://doi.org/10.1109/ACIIAsia.2018.8470330

Haro-de-Rosario, A., Sáez-Martín, A., & del Carmen Caba-Pérez, M. (2018). Using social media to enhance citizen engagement with local government: Twitter or Facebook? *New Media & Society*, *20*(1), 29–49.

Hassan, L. (2017). Governments Should Play Games: Towards a Framework for the Gamification of Civic Engagement Platforms. *Simulation & Gaming*, *48*(2), 249–267. https://doi.org/10.1177/1046878116683581

Hassan, L., & Hamari, J. (2019). Gamification of e-participation: A literature review. *Proceedings of the Annual Hawaii International Conference on System Sciences*, *2019-January*, 3077–3086.

Hassan, L., & Hamari, J. (2020). Gameful civic engagement: A review of the literature on gamification of e-participation. *Government Information Quarterly*, *37*(3), 101461. https://doi.org/10.1016/j.giq.2020.101461

Hassan, L., Morschheuser, B., Alexan, N., & Hamari, J. (2018). First-hand experience of why gamification projects fail and what to do about it. *2018 the 2nd International GamiFIN Conference*, 141–150.

Hassan, L., & Nader, A. (2016). Gamification design in action: The practical cases of gamification platforms for employee work motivation and citizens' civic engagement. *PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ICT MANAGEMENT FOR GLOBAL COMPETITIVENESS AND ECONOMIC GROWTH IN EMERGING ECONOMIES (ICTM 2016)*, 67–70.

Huang, L., Deng, C., Hoffman, J., Hadi Mogavi, R., Kim, J. J., & Hui, P. (2024). Long-Term Gamification: A Survey. In X. Fang (Ed.), *HCI in Games* (pp. 32–43). Springer Nature Switzerland.

Hunicke, R., LeBlanc, M., Zubek, R., & others. (2004). MDA: A formal approach to game design and game research. *Proceedings of the AAAI Workshop on Challenges in Game AI*, *4*(1), 1722.

Iacovides, I., Jennett, C., Cornish-Trestrail, C., & Cox, A. L. (2013). Do games attract or sustain engagement in citizen science?: A study of volunteer motivations. *CHI '13 Extended Abstracts on Human Factors in Computing Systems*, 1101–1106. https://doi.org/10.1145/2468356.2468553

Irvin, R. A., & Stansbury, J. (2004). Citizen participation in decision making: Is it worth the effort? *Public Administration Review*, *64*(1), 55–65.

Jüni, P., Holenstein, F., Sterne, J., Bartlett, C., & Egger, M. (2002). Direction and impact of language bias in meta-analyses of controlled trials: Empirical study. *International Journal of Epidemiology*, *31*(1), 115–123.

Kaur, M., Buisman, H., Bekker, A., & McCulloch, C. (2022). *Innovative capacity of governments: A systemic framework*.

Kazhamiakin, R., Marconi, A., Perillo, M., Pistore, M., Valetto, G., Piras, L., Avesani, F., & Perri, N. (2015). Using gamification to incentivize sustainable urban mobility. *2015 IEEE First International Smart Cities Conference (ISC2)*, 1–6.

Kongeseri, S., & Coley, C. (2019). Design of a Collaborative Tabletop Game for Civic Engagement: Serious Games in Rural India. In N. Zagalo, A. I. Veloso, L. Costa, & Ó. Mealha (Eds.), *Videogame Sciences and Arts* (Vol. 1164, pp. 86–98). Springer International Publishing. https://doi.org/10.1007/978-3-030-37983-4_7

Kumagai, S., & Ilorio, F. (2020). *Building trust in government through citizen engagement*. World Bank.

Latifi, G. R., Monfared, M. P., & Khojasteh, H. A. (2022). Gamification and citizen motivation and vitality in smart cities: A qualitative meta-analysis study. *GeoJournal*, *87*(2), 1217–1230. https://doi.org/10.1007/s10708-020-10295-0

Lee, C.-S., Foo, J.-J., Sangar, V. J., Chan, P.-Y., Hor, W.-K., & Chan, E.-K. (2017). A Knowledge Management-Extended Gamified Customer Relationship Management System. *2017 International Conference on Soft Computing, Intelligent System and Information Technology (ICSIIT)*, 341–346. https://doi.org/10.1109/ICSIIT.2017.46

Li, X., Wu, L., Xie, T., & Wang, T. (2023). The evolution of public participation under dynamic government intervention in nuclear NIMBY events: A network evolutionary game method. *Environmental Science and Pollution Research*, *30*(24), 65026–65040. https://doi.org/10.1007/s11356-023-26662-6

Lopez, L. S., Basu, A., Blagrave, K., Bove, G., Stewart, K., Bazely, D., & Sharma, S. (2024). Establishing a long-term citizen science project? Lessons learned from the Community Lake Ice Collaboration spanning over 30 yr and 1000 lakes. *Limnology and Oceanography Letters*, *9*(2), 99–111.

Martín-Martín, A., Orduna-Malea, E., Thelwall, M., & López-Cózar, E. D. (2018). Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. *Journal of Informetrics*, *12*(4), 1160–1177.

Mendez, J. I., Ponce, P., Meier, A., Peffer, T., Mata, O., & Molina, A. (2019). Framework for promoting social interaction and physical activity in elderly people using gamification and fuzzy logic strategy. *2019 IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, 1–5.

https://doi.org/10.1109/GlobalSIP45357.2019.8969110
Michael, D., & Chen, S. (2011). *Serious games: Games that educate, train, and inform* (Nachdr.). Course Technology.
Minge, M., Bürglen, J., & Cymek, D. H. (2014). Exploring the Potential of Gameful Interaction Design of ICT for the Elderly. In C. Stephanidis (Ed.), *HCI International 2014—Posters' Extended Abstracts* (Vol. 435, pp. 304–309). Springer International Publishing. https://doi.org/10.1007/978-3-319-07854-0_54
Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & PRISMA Group*, t. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, *151*(4), 264–269.
Moreira, F., Ferreira, M. J., Escudero, D. F., Pereira, C. S., & Durao, N. (2020). Teaching and learning Modelling and Specification based on gamification. *2020 15th Iberian Conference on Information Systems and Technologies (CISTI)*, 1–6. https://doi.org/10.23919/CISTI49556.2020.9140829
Morrison, A., Polisena, J., Husereau, D., Moulton, K., Clark, M., Fiander, M., Mierzwinski-Urban, M., Clifford, T., Hutton, B., & Rabb, D. (2012). The effect of English-language restriction on systematic review-based meta-analyses: A systematic review of empirical studies. *International Journal of Technology Assessment in Health Care*, *28*(2), 138–144.
Mossberger, K., Tolbert, C. J., & McNeal, R. S. (2007). *Digital citizenship: The Internet, society, and participation*. MIt Press.
Padilla-Zea, N., Burgos, D., Holloway, G., & Cullen, J. (2022). Social interaction and gamification with youth at risk of social exclusion: The technological approach of the Keystone project. *Entertainment Computing*, *43*, 100502. https://doi.org/10.1016/j.entcom.2022.100502
Palacin-Silva, M. V., Knutas, A., Ferrario, M. A., Porras, J., Ikonen, J., & Chea, C. (2018). The Role of Gamification in Participatory Environmental Sensing: A Study In the Wild. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 1–13. https://doi.org/10.1145/3173574.3173795
Peischl, B., Schantl, J., & Holzinger, A. (2014). Energizing People's Work—Transforming Organizations Through Gamification: *Proceedings of the 11th International Conference on E-Business*, 201–208. https://doi.org/10.5220/0005050502010208
Pflanzl, N., Classe, T., Araujo, R., & Vossen, G. (2017). Designing Serious Games for Citizen Engagement in Public Service Processes. In M. Dumas & M. Fantinato (Eds.), *Business Process Management Workshops* (Vol. 281, pp. 180–191). Springer International Publishing. https://doi.org/10.1007/978-3-319-58457-7_14
Prestopnik, N. R., & Crowston, K. (2011). Gaming for (Citizen) Science: Exploring Motivation and Data Quality in the Context of Crowdsourced Science through the Design and Evaluation of a Social-Computational System. *2011 IEEE Seventh International Conference on E-Science Workshops*, 28–33. https://doi.org/10.1109/eScienceW.2011.14
Prestopnik, N. R., & Tang, J. (2015). Points, stories, worlds, and diegesis: Comparing player experiences in two citizen science games. *Computers in Human Behavior*, *52*, 492–506. https://doi.org/10.1016/j.chb.2015.05.051
Prestopnik, N., & Souid, D. (2013). Forgotten island: A story-driven citizen science adventure. *CHI '13 Extended Abstracts on Human Factors in Computing Systems*, 2643–2646. https://doi.org/10.1145/2468356.2479484
Purwanto, A., Zuiderwijk, A., & Janssen, M. (2020). Citizen engagement with open government data: Lessons learned from Indonesia's presidential election. *Transforming Government: People, Process and Policy*, *14*(1), 1–30.
Quecke, A., & Mariani, I. (2021). How to design taskification in video games. A framework for purposeful game-based crowdsourcing. *CEUR Workshop Proceedings*, *2934*.
Raftopoulos, M. (2020). Has gamification failed, or failed to evolve? Lessons from the frontline in information systems applications. *GamiFIN*, 21–30.
Rehm, S., Foth, M., & Mitchell, P. (2018). DoGood: Examining gamification, civic engagement, and collective intelligence. *AI & SOCIETY*, *33*(1), 27–37. https://doi.org/10.1007/s00146-017-0711-x
Resek, C. L., Siniscalchi, P. P., Caetano, B. P., Oliveira, K. W. R., Paula, M. M. V., & Souza, J. M. (2024). Gamification of Citizen Participation: A Systematic Mapping. *IEEE Transactions on Games*, *16*(1), 1–15. https://doi.org/10.1109/TG.2022.3216750
Romero-Hernandez, A., Gonzalez Riojo, M., Diaz-Faes-Perez, C., & Manero-Iglesias, B. (2018). The Courtesy of Spain: Theater for the New Generations. *IEEE Revista Iberoamericana de Tecnologias Del Aprendizaje*, *13*(3), 102–110. https://doi.org/10.1109/RITA.2018.2862738
Ronzhyn, A., Wimmer, M. A., Viale Pereira, G., & Alexopoulos, C. (2020). Gamification in Public Service Provisioning: Investigation of Research Needs. *The 21st Annual International Conference on Digital Government Research*, 294–300. https://doi.org/10.1145/3396956.3398256
Schell, R., & Kaufman, D. (2016). Cognitive Benefits of Digital Games for Older Adults—Strategies for Increasing Participation: *Proceedings of the 8th International Conference on Computer Supported Education*, 137–141. https://doi.org/10.5220/0005878501370141
Schrape, N. (2014). *Gamification and governmentality*. meson press.
Sergeyeva, O., Bogomiagkova, E., Orekh, E., & Kolesnik, N. (2020). Gamification as a Trend in the Development of Civic and Political Participation. In A. Chugunov, I. Khodachek, Y. Misnikov, & D. Trutnev (Eds.), *Electronic Governance and Open Society: Challenges in Eurasia* (Vol. 1135, pp. 125–137). Springer

International Publishing. https://doi.org/10.1007/978-3-030-39296-3_10
Sheldon, K. M., & Elliot, A. J. (1999). Goal striving, need satisfaction, and longitudinal well-being: The self-concordance model. *Journal of Personality and Social Psychology*, *76*(3), 482.
Sigmund, K., & Nowak, M. A. (1999). Evolutionary game theory. *Current Biology*, *9*(14), R503–R505.
Steffens, F., Marczak, S., Figueira Filho, F., Treude, C., & Souza, C. R. (2017). A preliminary evaluation of a gamification framework to jump start collaboration behavior change. In *2017 IEEE/ACM 10th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE* (pp. 90–91). IEEE.
Sun, C., Liu, J., & Lu, G. (2023). Collaborative strategies of multiple stakeholders in green innovation of megaprojects based on a three-group evolutionary game. *Developments in the Built Environment*, *16*, 100279. https://doi.org/10.1016/j.dibe.2023.100279
Tennent, P., Pantidi, N., & Benford, S. (2016, July). *Playful Campaigning*. Proceedings of the 30th International BCS Human Computer Interaction Conference. https://doi.org/10.14236/ewic/HCI2016.39
Thiel, S.-K. (2015). Investigating the influence of game elements on civic engagement. *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2015 ACM International Symposium on Wearable Computers - UbiComp '15*, 819–823. https://doi.org/10.1145/2800835.2804403
Thiel, S.-K., & Lehner, U. (2015). Exploring the effects of game elements in m-participation. *Proceedings of the 2015 British HCI Conference*, 65–73. https://doi.org/10.1145/2783446.2783587
Thiel, S.-K., Reisinger, M., Röderer, K., & Fröhlich, P. (2016). Playing (with) Democracy: A Review of Gamified Participation Approaches. *JeDEM - eJournal of eDemocracy and Open Government*, *8*(3), 32–60. https://doi.org/10.29379/jedem.v8i3.440
Torres-Toukoumidis, Á., Romero-Rodríguez, L. M., Aguaded, I., Pérez-Rodríguez, A., & Sandoval, Y. (2017). Procedural model in the evaluation of public policy through gamification. *Revista de Administração Pública*, *51*(5), 810–827.
Van Zoonen, L. (2020). Data governance and citizen participation in the digital welfare state. *Data & Policy*, *2*, e10. https://doi.org/10.1017/dap.2020.10
Vanolo, A. (2019). Playable Urban Citizenship: Social Justice and the Gamification of Civic Life. In P. Cardullo, C. Di Feliciantonio, & R. Kitchin (Eds.), *The Right to the Smart City* (pp. 57–69). Emerald Publishing Limited. https://doi.org/10.1108/978-1-78769-139-120191004
Verba, S., Schlozman, K. L., & Brady, H. E. (1995). *Voice and equality: Civic voluntarism in American politics*. Harvard University Press.
Vicens, J., Perelló, J., & Duch, J. (2018). Citizen Social Lab: A digital platform for human behavior experimentation within a citizen science framework. *PLOS ONE*, *13*(12), e0207219. https://doi.org/10.1371/journal.pone.0207219
Wang, X., Cho, S.-H., & Scheller-Wolf, A. (2021). Green Technology Development and Adoption: Competition, Regulation, and Uncertainty—A Global Game Approach. *Management Science*, *67*(1), 201–219. https://doi.org/10.1287/mnsc.2019.3538
Wilis, N., & Parningotan Manik, L. (2022). The Effect of Visual Appeal, Social Interaction, Enjoyment, and Competition on Mobile Esports Acceptance by Urban Citizens. *Interdisciplinary Journal of Information, Knowledge, and Management*, *17*, 601–624. https://doi.org/10.28945/5045
Wohlin, C. (2014). Guidelines for snowballing in systematic literature studies and a replication in software engineering. *Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering*, 1–10.
Wolf, M. J. P. (Ed.). (2002). The Medium of the Video Game. In *The Medium of the Video Game* (pp. 193–200). University of Texas Press. https://doi.org/10.7560/791480-013