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Open Data Portals Engagement: A Cross-Country Analysis of Game Elements

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Abstract. Despite their pivotal role in promoting transparency, open data portals often struggle to engage citizens, functioning instead as static 'data graveyards'. While external activities, such as hackathons, can raise awareness, they do not directly cultivate sustained engagement within the portals. One promising approach to leverage citizens' engagement motivation is the integration of game elements to transform passive data access into interactive gamified experiences. However, despite its potential, there is limited research on gamified citizens' motivation to engage with open data portals. This paper examines how static and dynamic game elements are implemented across 31 open data portals. Lastly, we use the Self-Concordance Model to discuss the alignment between motivation, personal values, and game elements. Our findings reveal that most portals incorporate 'discovery' elements into their dataset-searching features, subtly gamifying exploration. Additionally, portals emphasising external activities, such as hackathons and events, often lack integrated social features, suggesting a trade-off between external engagement and sustained in-portal interaction. These findings challenge the assumption that open data engagement relies primarily on external initiatives, emphasising in-portal gamification instead. This study provides recommendations for policymakers to engage with users within open data portals.

Keywords: Open Data Portals · Gamification · Game Elements · In-Portal Engagement · Cross-Country Analysis · Self-Concordance Model

1 Introduction

Open data portals have enhanced transparency and drive innovation by increasing citizens' access to data [1]. However, they frequently fail to engage citizens, let alone make an impact [2]. Studies reveal risks that portals may operate as data graveyards, where datasets are published but rarely reused or discussed [3, 4]. Governments often rely on external activities, such as hackathons or data challenges [5], to increase open data engagement. Yet, these initiatives are costly [6], episodic [7], and exclusionary: they primarily attract highly skilled citizens, such as developers and data scientists, leaving non-expert citizens behind [8]. While hackathons generate short-term innovation, they often do not maintain sustained outcomes [9], especially for interaction within portals. There is a need to examine citizens' engagement motivation and alternatives to leverage them.

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Gamification, integrating game elements into the portals [10], offers a promising alternative by leveraging personal motivation. Despite the open data portals' gamification potential to transform interactions into enjoyable experiences, it remains underexplored. Recent studies focus on gamification in digital platforms [11], while not analysing the game elements in open data portals' context [12].

The lack of research on connecting citizens' motivation with game elements in open data portals highlights the need to examine the current implementation of game elements that engage citizens with open data portals. This paper addresses the issue by conducting the first cross-country gamification analysis, comparing and contrasting the implementation of game elements in the existing open data portals, and examining how each game element can be designed to engage citizens, conceptualised using motivation theory that relates to the personal value [13].

The paper proceeds as follows: Sect. 2 provides background on citizens' motivation and gamified open data portals. Section 3 outlines the research methodology. Section 4 presents the results. Section 5 discusses the findings. Section 6 concludes with recommendations.

2 Background

In this section, we provide an overview of the current engagement landscape of open data portals. We then conceptualise the citizens' motivation to engage with open data portals. Finally, we outline the game elements identified in the literature based on our prior study.

2.1 Open Data Portals' Engagement and Self-concordance Model

Open data portals emerged as part of global open government initiatives, which involve making governments' data publicly available [14]. However, despite their potential, open data portals face significant hurdles. Citizens' engagement in open data portals remains low, with studies noting that non-citizens outnumber datasets relevant to citizens [15]. Short-term initiatives, such as hackathons or events, while popular, often fail to sustain engagement beyond highly skilled individuals [5]. These engagement issues emphasise the need to examine citizens' motivation to engage with open data portals.

In this paper, we adopt the Self-Concordance Model (SCM) to conceptualise citizens' motivation to engage with open data portals. We chose SCM over other frameworks because it directly addresses different types of citizens' motivation, which was crucial for engaging open data portals [16] and digital platforms [17].

SCM addresses citizens' personal motivation: external, introjected, identified, and intrinsic [13]. External motivation stems from external rewards or consequences. Introjected motivation arises from an internalised sense of obligation to maintain a positive self-image. Identified motivation occurs when individuals engage because it aligns with their values. Lastly, intrinsic motivation refers to the satisfaction or enjoyment derived from engaging in the activity itself.

2.2 Gamification in Open Data Portals

One way of leveraging citizens' motivations is by using gamification, integrating game elements in non-game contexts [10]. Gamification has emerged as a powerful tool to motivate participation in digital platforms, such as in education and government sectors [18]. Civic tech tools, such as SeeClickFix, gamify civic reporting by publicly acknowledging citizens' contributions, demonstrating the potential of gamification to foster citizens' engagement [19]. While preliminary studies suggest that gamification could incentivise participation [20], its application in open data portals remains scarce [12].

Due to the limited research specifically addressing gamification in open data portals, we adopt a pragmatic approach to broaden the sources of information about gamification within digital governments. This approach builds on our accepted prior work that systematically reviewed 78 studies on gamified citizen engagement in government digital platforms, which identified the taxonomy of static and dynamic game elements and connected them with SCM [11].

In the next section, we outline our methodology for examining open data portals' implementation of game elements.

3 Research Methodology

To investigate the implementation of game elements designed to engage citizens in existing open data portals, we begin by outlining two research questions that shape our study: 1) What game elements engage citizens in existing open data portals? 2) What other engagement strategies are used in open data portals?

To address these questions, we adopt the Design Science Research (DSR) methodology since it combines practical knowledge with theoretical frameworks [21]. In this context, we analyse the game elements implementation of existing portals as "natural experiments" from the practical side, then we link them with citizens' motivation grounded in the Self-Concordance Model [13].

3.1 Open Data Portal's Analysis

We performed a systematic analysis of 31 open data portals selected through stratified sampling from DataPortals.org, representing 22 countries and five regions (North America, Europe, Asia-Pacific, Africa/Middle East, and Latin America), with one municipal open data portal for each region and three international organisations for comparisons (World Bank, UN, Kaggle). We accessed the portals between January and February 2025 and captured screenshots for later analysis. This time-limited experiment was designed with practical considerations in mind: 1) To avoid the labour-intensive task of exhaustively coding gamification elements across numerous open data portals, and 2) To minimise the need for repeated analysis should any updates occur to the portals. Pilot testing confirmed methodological saturation, with no new insights emerging after 25 portals.

For each region, we choose three to six national open data portals representing the country and one local open data portal representing a city. The detailed information can be

obtained in the supplementary material. In North America, we chose the USA, Canada, and Mexico, with New York City serving as the local portal. For Europe, we selected the UK, France, Germany, and the Netherlands for national portals, and Amsterdam served as the representative local portal. We included the EU portal to understand integrated data systems across member states. In the Asia-Pacific region, open data portals in India, South Korea, Singapore, Japan, Indonesia, and Australia should reflect the region's diversity, with Jakarta chosen as the local portal. In Africa and the Middle East, Bahrain, Saudi Arabia, Nigeria, Tunisia, and Qatar should represent the region, with Cape Town serving as the local-level open data portal. In Latin America, Brazil, Argentina, Colombia, and Chile open data portals should ensure regional diversity, with Buenos Aires as the local open data portal. From an international perspective, we chose the World Bank and United Nations portals to highlight globally shared governmental data, while Kaggle is selected to reflect private data portals made accessible to the public. These portals provide a comprehensive and representative snapshot of the global landscape of open data portals across various contexts and scales.

To conduct our analysis, we accessed each portal via a standard web browser (Microsoft Edge) and prioritised replicability by mimicking the experience of casual users without creating accounts. We analysed publicly available features, reflecting the experience of anonymous users accessing the portals from the internet. Navigation paths were standardised by exploring homepages, dataset catalogues, and tutorial sections where applicable, as well as testing interactive features such as search filters, dataset downloads, and feedback forms. This approach ensures that the findings capture the engagement opportunities accessible to citizens without specialised access or technical expertise. However, we acknowledge the limitations of our approach, such as the language barriers that required reliance on browser translation tools and the restricted access to features that require user accounts. Additionally, we recognise the temporal dynamics involved, as the portals' features may evolve and change following the audit.

3.2 Game Elements in Open Data Portals

To further analyse the game elements in each portal, we investigated various game elements explored in our prior study [11] as outlined in Table 1. Then, we conducted a comparative analysis to identify similarities and differences across regions and governmental and international portals. This approach enabled us to evaluate how diverse contexts impact gamification elements in the portals.

On the left side of the table, we analyse static game elements such as 'points', 'badges', and 'leaderboards', which remain consistent throughout user interactions. On the right side, we focus on dynamic game elements such as 'aesthetics', 'ease of use', and 'discovery', which evolve based on user engagement and experience.

In the next section, we discuss the findings from examining existing open data portals, focusing on the prevalence of game elements and their variations, and exploring citizens' engagement strategies in these portals.

Table 1. Game elements assessment for each portal based on our prior study [11].

Game element	Assessment (is there any..)	Game element	Assessment (is there any..)
Points	Point-related elements in the portal, such as rates, scores, number of views, and number of downloads	Progress	Visual progress for citizens is displayed in the portals
Badges	Citizens' achievements are shown in the portals, such as reuses	Aesthetics	Style or themes of portals
Leaderboards	Features that show the position of citizens in a competition on the portal	Ease of use	Easy user interface to use the portals
Levels	Ranks of citizens in the portal	Challenges	Information about the difficulties of analysing the data for citizens
Rewards	Rewards/prizes for citizens	Rarity	Rare items in the portal
Punishments	Penalties for citizens in the portal	Competition/Cooperation	Competition or cooperation for citizens in the portal
Avatars	Citizens' image/profile in the portal	Narrative	Story/information about the dataset
Virtual Goods	Goods/items that citizens get from the portal	Feedback	Feedback mechanism within the portal (not to be confused with feedback outside the portal, such as email)
Virtual Currencies	Coin/money that citizens get from the portal	Discovery	Elements for citizens to discover datasets or reuses, such as a search feature
Tutorials	Guidance on how to use the portal or how to analyse the data in the portal	Social interaction	Elements for citizens' interaction within the portal, such as chats/forums

4 Results

To analyse the findings, we structured our results with our approach to address the two research questions. First, we examine the game elements found in open data portals. Then, we explore the engagement strategies employed, whether through game elements or alternative methods.

4.1 Common Game Elements

Our analysis of 31 open data portals revealed widespread but uneven adoption of gamification mechanics, as outlined in Table 2.

Table 2. The prevalence of game elements (n = 31), with detailed information in the supplementary material.

Element	Portals Using (%)	Example
Discovery	100%	search filters, dataset categories
Ease of Use	100%	simple menu, few clicks
Aesthetics	100%	portals' style/theme
Narrative/Story	97%	dataset information, news, blogs
Tutorial	84%	guide, how to use, training
Achievements	58%	showcases, reuses
Points/Scores	55%	rating, stars, # views, # downloads
Feedback	35%	direct feedback per dataset
Avatars	16%	user's picture/avatars
Social Interaction	16%	In-portal comment
Others	<5%	

'Discovery' element, such as dataset searching by filters or categories, is the most common feature in all portals. We also noticed that 'aesthetics' and 'ease of use' are present in all portals. 'Narrative/story' and 'tutorials' are the second and third most common features in 97% and 84% of portals. 'Achievements', such as showcases, reuse, or use cases of datasets, exist in 58% of the portals, and 'points', including the number of views, downloads, or ratings, appear in 55% of the portals. The direct 'feedback' element is available in 35% of the datasets, while 'avatars' for personalizing users and 'social interaction' for interacting with users are present within 16% of the Portals. Other game elements, such as 'competition/cooperation', 'leaderboards', and 'virtual goods', were observed in just under 5% of portals. However, they occur outside the portal, including hackathons. Despite the high adoption of game elements on private international portal (Kaggle), government portals have shown minimal integration.

4.2 Engagement Strategies

Analysis of existing open data portals reveals a high reliance on external gamified activities, such as hackathons, data challenges, and community workshops, to stimulate engagement, often at the expense of fostering meaningful social interaction within the portal. While these external initiatives generate short-term participation, particularly among tech-savvy users, they often fail to cultivate sustained interaction within the portals, as evidenced by a low in-portal 'social interaction' element. For instance, the USA and India portals regularly host hackathons to crowdsource data-driven solutions. Yet, their portals lack built-in features that enable users to collaborate, share insights, or form communities directly within the interface.

Notably, a subset of portals (approximately 16%, as outlined in Table 2) prioritises in-portal social interaction mechanisms, such as discussion forums and message boards, without relying on external activities. For example, Brazil's open data portal integrates user comment sections alongside datasets, enabling citizens to ask questions, share knowledge, or suggest improvements directly. These portals demonstrate that embedding social elements within the portal interface can create self-sustaining engagement ecosystems, reducing reliance on episodic external events.

5 Discussion

Our analysis of 31 open data portals reveals that gamification remains inconsistently implemented. We highlight the dominance of 'discovery' elements, which subtly encourage data exploration, align with citizens' intrinsic motivation. The implementation of 'aesthetics' and 'ease of use' elements in all portals suggests the importance of intuitive user interface design when governments develop the portals. Together with the 'narrative/story' element, found in 97% of portals, they indicate open data portals' design that caters to users with intrinsic (discovery, ease of use, and aesthetics) and identified motivation (narrative/story) to interact with these portals, such as data enthusiasts. These findings align with Hammerschall's observation that intrinsic motivation, supported by dynamic elements, can sustain long-term engagement [22]. However, this reliance on intrinsic motivation may limit the portals' ability to attract new users who lack an initial interest in open data.

The limited presence of 'social interaction', 'avatars, and 'leaderboards' ($<16\%$) within open data portals highlights a missed opportunity to jumpstart and sustain engagement by combining the static game elements of introjected motivation (avatars and leaderboards) and the dynamic game element of intrinsic motivation (social interaction). This is noted by Thiel et al. [23], who underscore the short-term benefits of 'leaderboards' for starting initial engagement. However, they note that relying solely on it may not be enough to sustain long-term engagement. Our findings suggest a different perspective: most open data portals lack static elements to jumpstart engagement, yet they already incorporate dynamic elements that primarily cater to data enthusiasts. This narrow focus likely contributes to the low overall engagement, as these portals primarily appeal to niche segments. To address this, portals could benefit from incorporating static elements, such as 'tutorials', 'avatars, and 'leaderboards', to attract a broader audience

while also expanding dynamic features, such as 'social interaction', to better connect with diverse citizen groups and sustain their engagement.

Another finding reveals that portals with external gamified activities lack in-portal social interaction, suggesting a trade-off between external engagement and sustained in-portal interaction. This underscores a broader issue: external events often operate in isolation from the portal's core infrastructure, creating fragmented engagement that does not translate into habitual portal use for citizen engagement.

Despite the regional and sectoral diversity of our review's stratified sample, a key limitation lies in its underrepresentation of smaller municipal and non-English portals, potentially overlooking localised approaches. Future studies could explore these portals, providing a more comprehensive analysis of gamification implementation across different contexts. Additionally, future studies could also evaluate the effects of gamification on in-portal engagement, such as integrating 'social interaction' within the portals. Finally, although we outlined that gamification elements exist in several portals, implementing them requires developing requirements tailored to each portal.

6 Conclusion

This study provides the first cross-country assessment of gamification elements in open data portals, analysing 31 portals across five regions. Our findings reveal that the game elements are widely implemented, particularly about 'discovery', 'ease of use', 'aesthetics', and 'narrative/story'. These elements align with the principles of the Self-Concordance Model by fostering intrinsic motivation through enhanced control in dataset discovery processes (discovery) and an intuitive user interface (aesthetics and ease of use). They also support identified motivation by tailoring portals' narrative to resonate with citizens' values (narrative/story).

However, the combination of game elements designed to foster intrinsic motivation for citizen interaction within the portal (in-portal social interaction) and introjected motivation (avatars and leaderboards) is less prevalent in government portals. Furthermore, portals focusing solely on external engagements, such as hackathons and events, overlook in-portal engagement and may inadvertently undermine citizens' motivation to interact with others directly through the portals. This gap highlights an opportunity for governments to explore gamification strategies by combining static game elements to initiate citizens' participation and dynamic game elements to sustain the engagement within the portals.

For policymakers, these insights underscore the potential of gamification to transform open data portals from static repositories into interactive in-portal engagement platforms. Future research should focus on exploring context-specific gamification strategies and expanding in-portal citizen engagement, ensuring that open data portals evolve from data graveyards into engaging, interactive open data engagement.

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