An exploratory study to analyze the impact of using Growth Hacking on e-participation environments

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Abstract. *The dissemination of Information and Communication Technologies (ICTs) has fostered e-participation platforms, yet low citizen engagement remains a challenge, limiting their effectiveness. To address this, we applied the P-EPV framework to identify Growth Hacking strategies for increasing citizen engagement. Thus, we conducted a case study investigating the impact of these strategies in SoPa (an e-participation tool). We observed that applying Growth Hacking strategies through the P-EPV framework significantly boosted user participation, demonstrating its potential to enhance citizen engagement. These findings offer insights to improve other initiatives that face similar challenges.*

1. Introduction

The growth of Information and Communication Technologies (ICT) has transformed government-society relations, making technology a political and social tool. In this context, e-participation initiatives use ICTs to engage citizens in public decision-making, promoting transparency, efficiency, and inclusivity [Vicente and Novo 2014, Wang et al. 2024, Mota et al. 2020]. Therefore, e-participation tools facilitate communication between government administrators and citizens, enhancing city management. Furthermore, citizens' adoption of e-participation often involves reporting daily issues.

Research in this area focuses on awareness, motivation, and confidence in using these platforms, given their potential to improve public services while reducing costs and time [Sabani et al. 2018]. However, despite the availability of many e-participation platforms, challenges such as citizen engagement persist, with many initiatives failing due to a lack of sustained participation [Martins and Zambalde 2021, Boscarioli et al. 2017, Fernandes et al. 2018, Martins 2015, Coelho et al. 2022].

Moreover, technical and non-technical barriers contribute to low citizen engagement, with unawareness of e-participation tools being a significant obstacle [Oliveira and Garcia 2019]. There is also a need to make these tools as attractive as possible to users (citizens) [Oliveira and Garcia 2019].

Considering this issue, an analogy can be drawn between e-participation engagement and the rapid growth needed by emerging digital enterprises. While their goals differ, both scenarios use technology to maximize impact, suggesting that growth strategies from the digital business sector might help boost e-participation engagement.

One possible approach is digital marketing (such as paid online advertising and viral marketing), which can increase engagement by leveraging social media to spread awareness [Conway and Hemphill 2019, Akyol 2013]. Viral marketing, in particular, encourages users to share experiences, fostering organic participation [Akyol 2013, Kulkarni et al. 2020, Zajonc and Markus 1982].

For example, a citizen reporting an urban issue (e.g., a pothole) through the ”Co-lab” platform may later share their positive experience on social media, influencing others to participate. Therefore, the continuous flow of information generated through viral ads can positively impact the success and survival of an online community, which depends heavily on active user participation [Krasnova et al. 2017, Kaur et al. 2018].

In this context of transformations and experimentation, organizations recognize the need to refine their marketing approaches to attract and engage customers and drive rapid growth through a unique, innovative method known as Growth Hacking [Bismo et al. 2019]. This strategy makes marketing planning and execution more agile, developing methodologies for sustainable growth [Conway and Hemphill 2019].

In other words, Growth Hacking is a data-driven approach that optimizes results, accelerates a company’s growth, and continuously experiments with new strategies [Kemell et al. 2019, Ellis and Brown 2018]. Therefore, several frameworks were created to operationalize this process, such as High Time Testing proposed by Sean Ellis [Ellis and Brown 2018].

In recent years, Growth Hacking has expanded beyond emerging digital businesses and is now a strategic tool for addressing challenges in complex environments. For instance, its integration with big data analytics, digital marketing, and automation has been conceptualized as essential for developing dynamic marketing capabilities. By embedding a data-driven mindset in decision-making, organizations can adapt to rapidly changing scenarios and enhance their ability to innovate [Bargoni et al. 2023].

Moreover, insights from e-commerce participation reveal that user engagement follows a non-linear pattern, where sustaining engagement becomes progressively harder as participation stabilizes [Yi et al. 2023]. This underscores the importance of implementing complementary strategies to sustain user activity over time. In e-participation platforms, such strategies might include gamification, personalized feedback, or dynamic user notifications, which can help maintain user interest and mitigate the effects of diminishing participation over time.

This study leverages Growth Hacking as a framework to address engagement challenges in e-participation platforms. By building on principles from diverse fields, such as digital marketing and e-participation, the study positions Growth Hacking as a versatile strategy for overcoming barriers to user adoption and sustaining long-term engagement. These interdisciplinary contributions may lead to understanding how Growth Hacking can evolve beyond its origins, offering scalable and user-centered solutions for public and civic platforms.

In this article, we introduce P-EPV, a Growth Hacking framework designed to systematically address engagement challenges in e-participation through iterative hypothesis testing and statistical validation via A/B experiments. To validate the framework, we conducted a case study on the SoPa platform, an e-participation tool addressing urban issues. The P-EPV framework was implemented to enhance user acquisition, retention, and participation, yielding significant improvements in key engagement metrics.

Our study contributes to the field of digital government by bridging concepts from Growth Hacking, digital marketing, and civic technology. It offers a novel perspective on operationalizing strategies to tackle the critical engagement problem in e-participation platforms. Furthermore, our findings suggest that Growth Hacking is a viable strategy for enhancing citizen participation through technology.

2. P-EPV Framework

After analyzing several Growth Hacking frameworks, we decided to develop a new one that improves on the existing ones. Thus, we developed the P-EPV framework (see Figure 1) based on the researchers' experience applying Growth Hacking in other scenarios, which led to insights for adapting the framework to the context's specific needs.

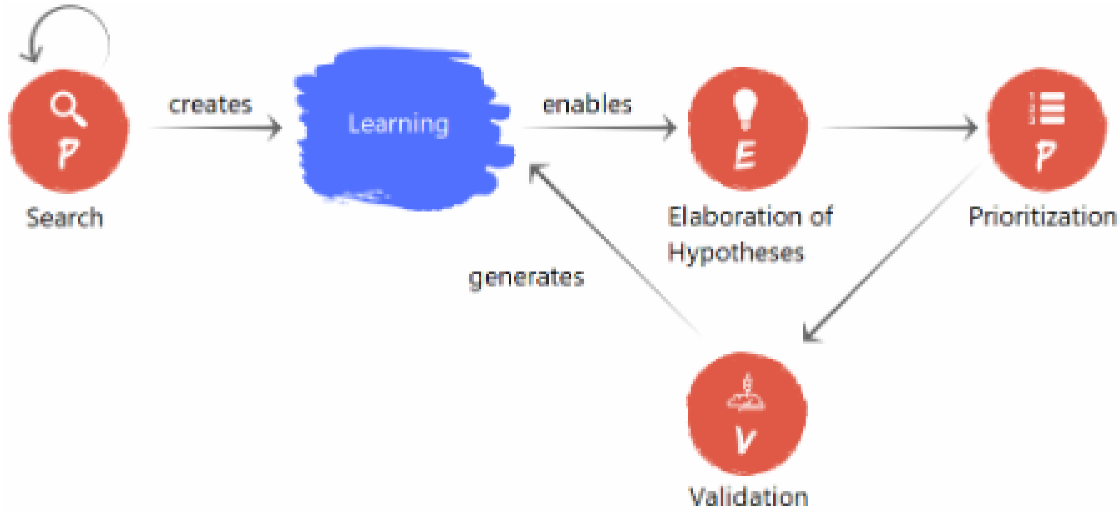

Figure 1. The P-EPV Framework

It consists of four stages: **(1) Research:** aims to generate data (learning) that serves as a basis for formulating hypotheses to improve the object of analysis and its impact on defined objectives. Ideally performed continuously using strategies such as interviews, questionnaires, data analysis tools (e.g., Woopra), or observing external objects to derive relevant insights; **(2) Elaboration of Hypotheses:** hypotheses are formulated based on the learning from the first stage, including improvement suggestions, influenced metrics, and supporting arguments; **(3) Prioritization:** hypotheses are ranked to determine validation order using, for instance, the ICE Score, which considers impact, confidence, and ease of implementation (each scored from 1 to 10 to determine priority) [Macca et al. 2024, Selvidge 2018, Piatek 2016]; **(4) Validation:** the highest-priority hypothesis undergoes planning, test implementation, execution, and analysis, generating lessons learned and findings on its veracity. Additional insights may emerge, leading to new hypotheses and optimization cycles.

As mentioned, the **Validation stage** consists of four phases: **(1) Planning**, which defines validation process details, including test type and execution method. A/B testing is commonly used, comparing two versions (A and B) to determine performance differences [Kohavi et al. 2007, Siqueira and de Paula 2018]; **(2) Implementation**, which involves creating the necessary mechanisms to execute the test. For an A/B test, this includes developing the modified version (B) and the source code for test logic; **(3) Execution**, which begins when the test is put into practice, requiring stopping criteria to determine the optimal duration. A/B tests should run for at least 7 days to account for behavioral variations, except for special occasions (e.g., Black Friday) [Siqueira and de Paula 2018]. Statistical significance must be at least 99% to minimize errors, and execution should not exceed 30 days unless interrupted earlier using estimates from, for instance, the MyMetric calculator [Siqueira and de Paula 2018, MyMetric 2018]; and **(4) Analysis** which evaluates collected data to determine the hypothesis' validity.

The first improvement brought by the P-EPV framework in relation to the other frameworks studied is decoupling the Research stage from the other stages. This makes it clearer that the Research stage can be performed continuously. Another improvement is coupling the stages of the validation process in just one stage. This simplifies the visualization of the continuous improvement cycle, as it allows it to be divided only into three main stages: Hypothesis Preparation, Prioritization, and Validation. In short, the P-EPV framework presents a new way of visualizing the steps that make up the operationalization of a Growth Hacking process.

3. Case study

In this study, we investigate how Growth Hacking can be applied to address engagement challenges in e-participation initiatives by reducing adoption barriers, improving usability, and promoting platform visibility. Given the vast landscape of e-participation initiatives, we limited our scope by focusing our analysis on SoPa, a social media platform that aims to provide a structured environment for its users to propose and discuss solutions to problems in their cities [**?**].

SoPa was used to support public participation in a city's master plan for sustainable development. However, five months after launch, it had only 183 registered users with minimal engagement, highlighting participation challenges and making it a suitable subject for analysis. Additionally, its role in facilitating public participation during the development of the city's master plan underscored its relevance as a real-world case study.

Since engagement is a broad and subjective concept [Armour 2018], planning the case study also required delimiting the scope for addressing this issue. Thus, we defined and investigated three sub-problems: user acquisition, retention of acquired users, and active participation.

Accordingly, the metrics evaluated were: (1) acquisition rate (number of users registering after visiting the page); (2) retention rate (number of users returning after registration); and (3) active participation rate (number of users engaging with content by adding questions, proposal solutions, comments, or reactions).

According to the P-EPV framework, the assumptions for improvement should consider the metrics that must be validated from a test once defined. This case study used the A/B test for data collection, elaboration, and hypothesis validation. Thus, we had to ensure that SoPa had a certain amount of access (traffic) because, to validate using the A/B test, the size of the data sample collected for evaluation directly impacts the statistical significance of the results [Azevedo et al. 2019].

Due to the uncertainty regarding the required traffic volume, the lower limits of the amount of access were defined based on the work performed by [Azevedo et al. 2019] and on simulation tools such as the MyMetric calculator [MyMetric 2018] and Neil Patel calculator [Neil Patel 2018]. Under these conditions, we defined that the lower limit of accesses for performing the Research stage would be 200 and, for the execution of each A/B test, 500 accesses (250 in each variant).

To carry out the case study, we initially had to prepare the instruments and the environment for execution. After this preparation, the case study stages followed the phases defined in the P-EPV framework. These stages will be described in section 3.3.

3.1. SoPa description

As previously mentioned, SoPa is a social media platform for e-participation [Caetano et al. 2020].On the homepage, users can register via e-mail and password or Facebook login. After user authentication, the main page is displayed in a feed-based interface with four main interaction options: "My questions", "My city", "Other locations", and "Categories".

In "My questions," users can see the problems they reported in their city; in "My city," they can see all the reported issues in their city; in "Other locations," they can check problems reported in any city in Brazil; and in "Categories," they can filter the issues by specific categories.

In SoPa, a question describes a problem occurring in a city. To create a question, users click on the area labeled "Any problems in your city?" and provide the problem's location (state, city, neighborhood), description, category (optional), and photo (optional). After submitting, the question becomes available for discussion of possible solutions with other users.

Participation includes creating questions and interacting with questions previously registered by other users. Users can like, comment, and have a detailed view of the problem discussion. In the detailed view, users can suggest solutions, comment, and react positively or negatively to proposals and comments already added.

3.2. Preparation for the case study

In our study, we used the Google Tag Manager tool to facilitate possible changes and to install other tools in SoPa (Woopra and Hotjar). Woopra is a data collection and analysis tool configured in SoPa to capture various user behavior metrics, including page views, entries, questions added, likes, comments, proposed solutions, and comments on solutions. Hotjar provides reports on user interaction, captures screen activity during navigation, and enables interactive research through pop-ups.

Over a month, we evaluated the amount of organic traffic from SoPa (traffic originating from unpaid sources). During this period, SoPa only had nine accesses. Therefore, we needed to adopt traffic-generating channels to reach the traffic volume previously stipulated. Thus, we adopted the strategy of paid adverts on Facebook to increase traffic. We chose this approach because the SoPa team had already used this platform to promote the tool in the cities where it was in operation. The ads were published over sixty-four days, requiring a total investment of R$ 954.24.

3.3. Application of the P-EPV framework to SoPa

Our Research phase, lasting thirteen days, involved three strategies: (1) analyzing the responses to an evaluation form available in SoPa, (2) conducting an intuitive survey simulating interaction, and (3) using data collection tools (Woopra and Hotjar).

Data collected by Woopra and Hotjar showed us that 148 users accessed OMITTED FOR REVIEW's home page, with 55 (37.2 %) signing up. However, engagement was low, with only a few users posting, liking, commenting, or proposing a solution. Additionally, 47 registrations (85%) were made via Facebook and only 8 (15%) via e-mail.

The data gathered in this stage generated sufficient information for the initial execution of the Elaboration of Hypotheses stage, which lasted fourteen days and resulted in 14 hypotheses to improve user acquisition, retention, and active participation of SoPa. Shortly after the conclusion of this stage, we executed the Prioritization stage, in which we ranked these hypotheses according to the impacted metric and the ICE score.

Five hypotheses were formulated for user acquisition: (H1) making the landing page more descriptive (ICE: 25); (H2) reducing registration form fields (ICE: 19); (H3) improving mobile usability (ICE: 18); (H4) allowing feed access without registration (ICE: 17); and (H5) compressing images for faster loading (ICE: 16).

Two hypotheses were formulated for retention: (H6) sending weekly summary e-mails to encourage return visits (ICE: 28) and (H7) implementing notifications to re-engage users (ICE: 21).

Finally, seven hypotheses were formulated for active participation: (H8) displaying a video tour when the user first accesses the site (ICE: 26); (H9) replacing the current feed with a feed with questions from all cities (ICE: 23); (H10) implementing a reward system (ICE: 21); (H11) adding a city summary screen (ICE: 12); (H12) adding the option for anonymous contributions (ICE: 12); (H13) highlighting the "Add proposal" field (ICE: 11); and (H14) compacting the interaction area with expandable forms (ICE: 10).

We chose the hypotheses with the highest priority for increasing acquisition and retention rates for the validation phase (hypotheses 1 and 6, respectively). Regarding the A/B test, we considered that only tests with statistical significance greater than 99% can ensure that the challenger variant is better or worse than the control variant for the assessed metric. The minimum period of 7 days and a maximum of 15 days for an A/B test execution were also defined. After this minimum period, the test could be interrupted if it reached a value greater than 99% of statistical significance.

3.3.1. Validation of Hypothesis 1

To validate hypothesis 1, we created a descriptive landing page (DLP) to provide more details about SoPa, with buttons leading to the original landing page (OLP). Additionally, we designed an A/B test to evaluate its impact.

We created two possible streams that the user could perform during the A/B test: the original flow, in which they were directed to the OLP and could register, or the hypothesis 1 proposed flow, in which they first visited the DLP before accessing the OLP.

The test lasted 15 days, with 360 accesses in SoPa. Of these hits, 174 were directed to the control variant and 186 to the challenger variant. Furthermore, the control variant had 65 registrations (37.4% acquisition rate), while the challenger variant had 54 registrations (29.0% acquisition rate). Based on these results, we can state, with 96% statistical significance, that the control variant outperformed the challenger by 29%.

Regarding the number of different users who participated, 15 (8.6%) accessed the control variant, and 19 (10.2%) accessed the challenger variant. From these results, we can state, with 70% statistical significance, that the challenger variant obtained a performance 19% superior to the control variant.

Although the threshold of 99% statistical significance was not reached in either case, the data indicated that 68.4% of the users who accessed the OLP via the DLP button completed registration, compared to 37.4% of those who accessed the OLP directly. This suggests that better-informed users were more likely to register, leading us to develop a new possible improvement: allowing the DLP button to direct users straight to Facebook registration. Given that most sign-ups occurred via Facebook and all ads were run on Facebook, this change could reduce friction by removing a step from the registration process. This new hypothesis received an ICE score of 21 and was included in the validation stage.

3.3.2. Validation of Hypothesis 1-1

To validate hypothesis 1-1, we modified the DLP buttons' functionality to redirect users directly to the Facebook registration. We created an A/B test for this validation, with the first variant representing the original flow and the second the proposed flow. In other words, users clicking the registration buttons were redirected to Facebook, where they could authorize the registration and be sent to the feed.

The test lasted 7 days, with 248 accesses to SoPa. Of these, 121 users were directed to the control variant and 127 to the challenger variant. The results showed that 48 users in the control group completed the registration process, yielding a 39.7% acquisition rate. In the challenger group, 53 users (41.7%) clicked the registration button, and 47 completed the process, with a 37.0% acquisition rate. This indicates, with 67% statistical significance, that the control variant outperformed the challenger variant by 8%.

In terms of active participation, 11 (9.1%) users in the control group and 14 (11.0%) in the challenger group participated in SoPa. Thus, we can state, with 70% statistical significance, that the challenger variant performed 22% better than the control variant.

Although the threshold of 99% statistical significance was not reached when comparing variants A and B, we can say, with 99% statistical significance, that the version of the challenger variant presented by hypothesis 1-1 is 30% better than the version of the challenger variant presented by hypothesis 1.

3.3.3. Validation of Hypothesis 6

We also validated hypothesis 6 through an A/B test. From the users who registered during the validation of hypotheses 1 and 1-1, we selected 200 users, and 100 were randomly assigned to receive an e-mail with statistics and access links to SoPa. The e-mail was sent, and the results were analyzed one week later to determine the proportion of users who returned to SoPa after registration. Specifically, we focused on the number of users who returned to SoPa at least once at minimum intervals of 1 day and 7 days after registration.

We observed that 4 (4%) users who did not receive the e-mail re-logged within 1 day after registration, and none re-logged after 7 days. Of the users who received the e-mail, 12 (12%) re-logged within 1 day after registration, and 6 (6%) re-logged within 7 days after registration.

Regarding the e-mail, we used the Bitly tool to measure the number of user clicks. There were four distinct links in the body of the e-mail, three leading to specific issues and one to the home page of SoPa. The link to the home page received 9 clicks, while the issue-specific links received 4, 5, and 3 clicks, respectively. However, the number of unique users clicking on the links could not be determined.

Based on the results, we can conclude the following: (1) With 99% statistical significance, users who received the e-mail had a 225% higher retention rate within the 1-day window than those who did not; and (2) With 100% statistical significance, users who received the e-mail had a higher retention rate within the 7-day window compared to those who did not.

Since none of the users who did not receive the e-mail re-accessed SoPa after the minimum interval of 7 days after registration, the improvement rate for this time window could not be calculated. Nonetheless, the results achieved the threshold of 99% statistical significance, supporting the adoption of the e-mail strategy proposed by this hypothesis.

3.4. Results discussion

We validated three of the fifteen hypotheses formulated during the P-EPV framework application to SoPa. Two were on the acquisition metric and obtained significant results regarding active participation. The other hypothesis was related to the retention metric.

Although hypotheses 1 and 1-1 did not meet the previously established threshold of 99% statistical significance, we gained valuable insights from inserting a more detailed landing page at the start of the registration flow. Additionally, hypothesis 6, related to retention, reached statistical significance, indicating that sending e-mails is an effective strategy for increasing retention in SoPa.

Applying paid advertisements (over 64 days) significantly boosted user engagement during the case study. In the three months prior to the P-EPV framework application, user registrations increased from 182 to 203 (21 new registrations, averaging 7 new users per month). Following the application of the P-EPV framework, registrations grew from 182 to 682 (500 new registrations), averaging 238 users per month. This represents a 274% total increase in registered users and a 3300% increase in the average monthly registration rate.

In terms of the number of questions, the total increased from 56 to 59 (3 new questions) before the P-EPV framework application and from 59 to 170 (111 new questions) during the application, raising the average from 1 to approximately 53 questions created per month. This led to a 188% total growth and a 5200% increase in the average monthly creation of questions.

No proposals were created in the 3 months preceding the application of the P-EPV framework to SoPa. During the period in which the P-EPV framework was applied to SoPa, the number of proposals increased from 23 to 33, totaling 10 new solution proposals created in SoPa, which represents an average of approximately 5 issues created per month and a 43.5% growth in the total number of proposals. Since there were no proposals created in the 3 months preceding the application of the P-EPV framework to SoPa, it was not possible to determine the growth in the average number of solution proposals created per month.

Thus, in the period of application of the P-EPV framework to SoPa, the total number of registered users, the total number of questions created, and the total number of solution proposals grew significantly compared to the last months before the study.

Finally, the P-EPV framework application generated two main contributions. The first was the validation of 3 hypotheses of possible improvements that can be made in SoPa to increase user engagement. It can be concluded that 1 of these hypotheses is valid, i.e., if adopted, they will have 99% statistical significance to bring improvements concerning user engagement to SoPa. The second contribution was the remarkable growth in user engagement when the P-EPV framework was applied to SoPa. This increase was mainly due to the use of paid advertisements.

Based on these two contributions, it can be concluded that adopting Growth Hacking as a continuous improvement process can contribute significantly to solving engagement-related challenges in e-participation initiatives.

4. Conclusions and Future Work

This study's main scientific contribution is the real-world e-participation case study demonstrating how Growth Hacking can serve as an effective strategy to address engagement challenges in e-participation initiatives. Furthermore, the P-EPV framework, proposed to operationalize Growth Hacking, offers a structured approach to improving user engagement and is applicable to other e-participation platforms.

The study's technical contribution lies in applying a combination of tools (including Google Tag Manager, Woopra, and Hotjar) within the context of citizen participation and digital government. While these tools are not novel on their own, their integrated use in this domain has the potential to enhance and accelerate data collection, analysis, and hypothesis validation through A/B testing, ultimately supporting more effective engagement strategies.

Regarding the specific case of SoPa, this study validated several improvements, leading to significant outcomes, including a 274.7% increase in registered users, a 188.1% increase in questions created, and a 43.5% increase in proposed solutions. These results highlight the framework's potential to enhance digital engagement effectively.

Even though we focused on quantitative results, the P-EPV framework application also allowed us to identify some patterns of user behavior and insights into optimizing the platform experience. Notably, users who were more informed about the platform before registering were more likely to actively engage in the platform's activities. This indicates the need for strategies that make SoPa more informative for current and future users.

One such strategy is user onboarding, which plays an important role in digital adoption by guiding and educating a new user on how to effectively interact with a digital product or service, ultimately fostering long-term loyalty and improving engagement. An effective onboarding process educates users on navigating the intended product or service and helps them recognize its value and potential to fulfill their needs [Digital Adoption Team 2023].

The study does, however, face some limitations. A specific limitation of the P-EPV framework is the subjectivity in the Prioritization step, where ICE Scoring, although widely adopted, may lead to suboptimal prioritization. Another limitation was the amount of social media traffic. Despite implementing paid advertisements to address this, limited financial resources and insufficient time hindered the ability to increase traffic enough to achieve more relevant statistical significance for validating hypotheses 1 and 1-1.

Additionally, the two-month time frame for applying the P-EPV framework to SoPa limited the number of hypotheses that could be validated and the formulation of new ones. The framework was also applied to only one e-participation initiative, limiting the replicability of the results. Future research could benefit from a more extended study period and applying the framework across multiple platforms for broader insights.

Further research could also explore more efficient dissemination techniques for e-participation initiatives, such as viral marketing, which several companies have successfully employed for massive user capture [Schulze et al. 2014]. Another direction could involve validating the hypotheses and improvements proposed for SoPa through longer-term studies, which might yield more robust and actionable conclusions. Another possibility would be exploring other digital marketing techniques that better inform users, such as onboarding (previously mentioned). Moreover, applying Growth Hacking strategies to different e-participation platforms could reveal new insights into their adaptability and effectiveness in varied contexts.

Finally, the P-EPV framework proved effective in improving engagement, suggesting that it can be replicated in other e-participation platforms with the necessary context adaptations. Therefore, we believe other professionals in this field can use this study to help them structure experiments that optimize platforms' interfaces and outreach campaigns, and researchers can explore it to better understand the factors that influence citizen engagement in e-participation initiatives.

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