

Citizenpedia: A Human Computation Framework for the e-Government Domain

Ivan Pretel, Unai Lopez-Novoa,
Enrique Sanz-Yagüe, Diego López-de-Ipiña
Deusto Institute of Technology, DeustoTech,
University of Deusto
Avda. de las Universidades 24, 48007, Bilbao, Spain
{ivan.pretel,unai.lopez,enrique.sanz,dipina}@deusto.es

Vincenzo Cartelli, Giuseppe Di Modica, Orazio Tomarchio
BEng Business Engineering, Catania, Italy
v.cartelli@business-engineering.it
Department of Electrical, Electronic and Computer Engineering,
University of Catania, Viale A. Doria, 6, Catania, Italy
{giuseppe.dimodica,orazio.tomarchio}@dieei.unict.it

Abstract—Human computation relies on crowds of people to perform large workloads, and in this work, we want to exploit this potential to improve the experience of e-government and the use of e-services. To that end we present the Citizenpedia, a human computation framework aimed at fostering citizens involvement in the public administration. The Citizenpedia is presented as a web application with two main tools: the Question Answering Engine, where citizens and civil servants can post and solve doubts about e-services and public administration, and the Collaborative Procedure Designer, where citizens can collaborate with civil servants in the definition and improvement of new administrative procedures and e-services. In this work we present several contributions: first, the design of the Citizenpedia concept, and then, its evaluation through a set of online surveys that were filled by 152 citizens and 63 civil servants from three different countries. The surveys served to successfully validate our design, and also to provide feedback on new features that were not taken into account in the first place. We finally present the software architecture of the Citizenpedia and provide the link to its source code.

Keywords—Human computation; E-government;

I. INTRODUCTION

Human computation or Human-based computation (HBC) is a paradigm where humans perform small tasks and a computer system is in charge of orchestrating their results. These tasks would require complex computer algorithms to be accomplished, but due to their nature they are easily completed by humans, e.g. to recognize an image or some manipulated and struggled text [1][2].

In the private sector, human computation is used massively in different fields [3][4]. In general, Web 2.0 relies on users' contents as their core business, e.g., in web applications where the contents are almost solely provided by users, such as YouTube, Flickr or TripAdvisor. On the other hand, in the public sector, fields such as e-government or emergency response also benefit from human computation, e.g. in the policy making activity [5] or in emergency management [6].

However, the potential of human computation in the field of enhancing and streamlining e-service contents and workflows is not fully addressed in the literature. In an intent to fill this void, we present the Citizenpedia¹, a tool aimed at fostering citizen's involvement in the public administration,

and sharing improvements on public resources in a semi-automatic basis. The main idea is to bring concepts and technology already used in private industry sectors to the Public Administration (PA), such as the idea of continuous improvement of processes and the exploitation of cognitive systems technologies.

The Citizenpedia is a web-based framework that offers two main tools to citizens and civil servants: the Question Answering Engine, which enables the citizens to post and solve doubts around e-services and public administration, and the Collaborative Procedure Designer, which allows the civil servants to model public services and workflows, to then expose them to the citizens and gather their feedback.

In this paper we present two main contributions: first, the design and an early implementation of the Citizenpedia, and second, an evaluation of its design, conducted as a set of online surveys which were filled by 215 persons across three different countries. This evaluation has been used to drive the implementation of the Citizenpedia, whose source code is publicly available.

The remainder of this paper is structured as follows: we present in Section II an overview of the state of the art in human computation techniques, with focus on the e-government domain. Section III describes the overall concept and design of the Citizenpedia, and Section IV how we evaluated it through a set of online surveys. Section V describes the software architecture of the Citizenpedia and, finally, we draw some conclusions and describe the next steps in Section VI.

II. RELATED WORK

This section compiles some of the most relevant contributions in the field of human computation that have served as reference in the development of the Citizenpedia. We have divided the section in two groups: already existing platforms, such as online web platforms or mobile applications, and contributions found in the scientific literature.

¹The Citizenpedia is a development part of the European H2020 SIMPATICO project. It has no relationship with the proposal presented by Thalos in [7] also named *Citizenpedia*.

A. Deployed applications

The most popular human computation platform is Amazon Mechanical Turk², whose lemma is *Artificial Artificial intelligence*. It is a marketplace where users post jobs and offer money for getting them done. Waze³ is a popular GPS path-guiding application for smartphones and tablets. It calculates the path to be followed by a user driving a car, and shows alerts about traffic jams, accidents, etc... These alerts are introduced by other users in the system. Other less-known tools are MalariaSpot⁴ and GalaxyZoo⁵, online platforms that assign small processing tasks to humans giving reputation as reward.

Focusing on the area of PA and e-government, the mySociety⁶ e-democracy project offers many online democracy tools for citizens. These tools are released as open source projects, and many councils in the UK have adopted them to ease the burden between citizens and administrations. We want to highlight two of them: FixMyStreet⁷, a map of the city where citizens can comment on roads or paths that need mending, and WhatDoTheyKnow⁸, a public question & answer portal, where citizens post questions and requests to the local administrations.

Another tool tackling e-government and e-democracy issues is LiquidFeedback⁹, an open source web platform for proposition development and decision making.

B. Scientific contributions

In [8] authors propose a methodology that enable public administrations to get more out of the comments that citizens post in social networks for policy making. This methodology is composed by four phases in a cycle (Listen, Analyze, Act and Receive), and for each phase the technologies that should be used are described. This work has been extended in [9].

In [10] the author presents a survey paper about gamification applied to public services. It contains an extensive essay on the topic and a discussion on how to apply gamification into public services. In contrast, the paper presented in [11] describes a practical experience on the topic: the experience introducing gamification in a online service of the Department of Human Services of the Australian Government.

Finally, some works [12][13] try to promote the use of Business Process Management (BPM) practices in the public administration to improve the quality of e-services. Specifically, the platform in [12] is created using the concepts of user-centered design and gamification design methodologies.

²Amazon Mechanical Turk - <https://www.mturk.com>

³Waze - <https://www.waze.com>

⁴MalariaSpot - <http://malariaspot.org>

⁵GalaxyZoo - <https://www.galaxyzoo.org>

⁶mySociety - <https://www.mysociety.org>

⁷FixMyStreet - <https://www.fixmystreet.com>

⁸WhatDoTheyKnow - <https://www.whatdotheyknow.com>

⁹LiquidFeedback - <http://liquidfeedback.org>

III. THE CITIZENPEDIA DESIGN

The Citizenpedia aims to complement e-government environments with a place where citizens and civil servants can share knowledge, and more specifically, a place where citizens can solve their doubts and actively take part in the enhancement of the e-services. To that end, we have designed the Citizenpedia with two complementary tools, which are described as follows.

A. Question Answering Engine

The Question Answering Engine (QAE) is a tool which provides a place where citizens post and resolve doubts regarding e-services and public administration. The chosen look-and-feel for this place is similar to popular question & answer places.

The main functionality of QAE is to create and answer questions in a public manner. Users are encouraged to communicate in a public manner, with the aim for all the generated information to remain over the time. This is usual in QAE places in the field of engineering (e.g. Stack Overflow), where sometimes an answer written two or three years past in time is useful for the user looking for a doubt. In addition, questions are searchable and sortable.

The QAE design considers to have two main roles: user and moderator. Initially, every citizen is a user and every civil servant is a moderator. Users can search along Citizenpedia and post content. Moderators have higher privileges, i.e., permission to edit/delete content from other users, addressing the problem of low quality content.

In order to keep the user engaged, a rewarding and reputation mechanism is considered. Each time a user conducts an action (e.g. posting/answering a question, leaving a comment), it is recorded and several points are given. Upon certain amount of points, badges are given. This enables users to gain reputation and distinguish most active participants in the community. In addition, we consider that once a user reaches certain level of reputation, he/she gains some moderator-role skills.

B. Collaborative Procedure Designer

The Collaborative Procedure Designer (CPD) is a tool to describes current e-services in the form of flowcharts/diagrams, that enables citizens to comment on them. The core of the CPD is a model that allows the definition of multiple hierarchical views, each providing a representation of the procedure with a growing level of details.

Currently, the CPD shows two low-hierarchy views: the *value-chain* view and the *interaction* view. The *value-chain* provides information concerning the sequential phases that the procedure is broken into. From this view it is possible to learn the name of the phases and realize the phases' temporal order. By expanding a specific phase, an *interaction* view gets displayed. This view shows a flow of the interactions

between the citizen and the PA that are carried out in that phase. For any interaction, it is pointed out who of the two actors is the interaction’s initiator. Also, the communication channel through which the interaction will occur is explicitly indicated by means of specific icons.

While the citizen is the user that will benefit of these views, the civil servant is in charge of drawing the views. In fact, the latter is provided with a graphical designer and a set of drawing tools that they can use to create the hierarchical views of an administrative procedure. In the role of citizen, the user is also allowed to interact with the diagram by asking specific questions whenever there is unclear information or further descriptions are needed. The role in charge of responding to the citizen is the civil servant. Both the citizen’s questions and the civil servant’s responses are not directly handled by the CPD but, instead, are handed over to the QAE.

The final objective of the CPD is to implement a collaborative environment on which the stakeholders (citizens and civil servants) cooperate to the design and the improvement of administrative procedures. In order to stimulate such participation and cooperation, the CPD adopts the same rewarding and reputation mechanism designed for the QAE.

IV. DESIGN EVALUATION

Prior to the implementation of the Citizenpedia, we conducted an evaluation of its design. The goal was to validate our design decisions, and to gather the impressions from the potential users. This section details first how we prepared the evaluation and then, summarizes the results we obtained.

A. Evaluation setup

One of the aims of this evaluation was to reach the largest number of surveyed persons in a effective way. Thus, we discarded approaches like group meetings or interviews, and decided to conduct personal online surveys. This way, the distribution of the surveys would be instant (just by sharing the URL to the proper collective) and we could give plenty of time for the users to fill the forms.

The online survey was created using Google Forms and it was divided in two parts, each containing a mock-up video and some questions that the users had to answer. The first part of the survey was focused on the Question Answering Engine (QAE) and also in some general aspects of the Citizenpedia. The second part was related to the Collaborative Procedure Designer (CPD), and the video and questions were different depending on the user filling the survey (citizen or civil servant). The survey ended with some common demographic questions (e.g. gender, age,).

The surveys were distributed among citizens and civil servants of the following cities/regions: Sheffield (UK), Galicia (Spain) and Trento (Italy)¹⁰, and they were open for one month (June 2016). We created a survey per target region in each local language, i.e., English, Spanish and

Italian. All of the three contained the same question/answer set, translated to the corresponding language.

B. Results

Once the surveys were closed, we proceeded to the collection of the results and to their analysis. In this section we provide a summary of the results, described following the order of the questions in the surveys. Even though the surveys were conducted in three languages, we describe all the results in English for the shake of brevity.

Table I: Number of participants of the surveys by country and role

	England	Italy	Spain	Total
Citizens	5	34	113	152
Civil Servants	0	15	48	63

Table I shows the number of participants by country and role. Given the significant imbalance of answers per country, we grouped the answers of the citizens by age range of citizens in order to extract meaningful conclusions. The resulting groups are reported in Table II. In contrast, the answers for the civil servants were analyzed separately, as most of them were middle-aged. We will describe the answers of the civil servants at the end of this section.

Table II: Grouping of the citizen participants for analytical purposes

Group name	Age range (years)	Sample size
Youngsters	18-34	42
Middle Age	35-64	55
Elderly	65+	55

Initially, the survey showed to the participant a mock-up video of how a citizen solved a doubt using the QAE¹¹. After that, the first question aimed to measure discretionary use of Citizenpedia. As Table III exposes, the Citizenpedia platform would be a widely adopted solution to clarify issues related to procedures of public administration. The adoption level is directly associated to the age: the younger is the citizen, the higher is the solutions adoption. Several comments were gathered after this question and they were taken into account during the requirements elicitation.

Another interesting finding on the results was the high usage of Q&A platforms, discovered through the answers to the question reported in Table IV. More than the 55% of the user of all ages report to have previously used a Q&A engine to ask/post doubts. This finding is relevant, as a significant portion of the surveyed users find the Citizenpedia familiar. However, we also found that relatively low people devote time to answering questions in these portals.

¹⁰The regions where the survey was distributed correspond to the pilots of the SIMPATICO project.

¹¹Citizenpedia QAE mockup - <https://youtu.be/TyP38M1cFrc>

Table III: Answers to: *If you had access to such web portal to clarify these issues, would you use it?*

Youngsters	Middle Age	Elderly	Response
76.19 %	76.36 %	54.55 %	Yes, as a first choice
19.05 %	14.55 %	32.73%	Just when I am not able to go physically to the public administration
2.38 %	5.45 %	9.09 %	I dont think so
2.38 %	3.64 %	3.64 %	Other

Table IV: Answers to: *Have you ever used a question-answering portal?*

Youngsters	Middle Age	Elderly	Response
21.43 %	23.63 %	16.36 %	Yes, both to post and answer questions
47.62 %	49.09 %	40.00 %	Yes, to ask questions / post doubts
7.14 %	3.64 %	1.82 %	Yes, to answer other's questions
21.43 %	20.00 %	41.82 %	No, I've never used one
2.38 %	3.64 %	0.00 %	Other

Then, we asked the participants whether they found attractive gaining points as reward for answering questions. This is implemented in some Q&A portals where the more points gained, the more reputation in the portal. When a user reaches certain level of reputation, he gains permission to moderate or manage the portal. According to Table V, the youngest group can be persuaded using a virtual rewarding system as well as reputation. This last term, reputation, is not an effective motivation to enhance the participation of the rest of groups. However and according to several comments of the surveys participants, it is an important concept for them because it means reliability and quality. We found this comment by a participant relevant: *For me, a high reputation of the answers owner means high quality of the answers.*

Table V: Answers to: *In some question&answer portals users gain points as reward for answering questions. The more points gained, the more reputation in the portal. When a user reaches certain level of reputation, he gains permission to moderate and manage the portal. Do you see it as an attractive feature?*

Youngsters	Middle Age	Elderly	Response
50.00 %	29.09 %	27.27 %	Yes, it would encourage me to participate more actively in Citizenpedia
42.86 %	29.09 %	21.82 %	Yes, but I don't think that it would make me be more active
4.76 %	40.00 %	47.28 %	No
2.38 %	1.82 %	3.64 %	Other

Regarding the problems which citizens experienced during public administration procedures, Table VI exposes that the most common ones are related to the complexity of the documents and procedures. Despite that the three groups provide similar results, the youngest group has significantly

more problems interpreting the guidelines terms. Furthermore, information architecture and usability are very common issues inside the participants comments, for example: *I don't know which one is the correct web page, I am always lost browsing in e-services of the public administration...* Consequently, Citizenpedia should satisfy not only need of having a friendly description of procedures and terms, but also the need of an easy-to-use site.

Table VI: Answers to: *Think of your previous experiences with public administration. What kind of time-costly problems have you experienced*

Youngsters	Middle Age	Elderly	Response
69.05 %	49.09 %	43.64 %	The guidelines contained many hard terms to understand
52.38 %	49.09 %	49.09 %	The guidelines were too long
45.24 %	21.82 %	16.36 %	I was not sure if I was eligible (if the administrative process was applicable to me)
35.71 %	27.27 %	10.91 %	The required documents (passport, driving license, ...) were not clearly stated
4.76 %	14.55 %	9.09 %	Other

The most used channel to solve the most common problems depends on the age (see Table VII). Firstly, youngsters look up for a solution on the Internet as a main choice. The middle age group adds contacting with civil servants to the Internet browsing. Finally, the oldest group presents as a main choice a combination of asking a relative or a friend and Internet: asking somebody to find a solution through Internet because their lack of digital knowledge and experience.

Table VII: Answers to: *When suffering from any of the previous problems, where did you find help?*

Youngsters	Middle Age	Elderly	Response
45.24 %	34.55 %	40.21 %	I asked a relative/friend
40.48 %	41.82 %	30.91 %	I contacted with civil servants
69.05 %	41.79 %	45.45 %	I looked up for a solution on the Internet

In this last question (Table VII), we asked the participants who checked *I contacted with civil servants* option, to indicate which channel they used to do so. The results of this additional questions are shown in Table VIII: the most used channels are telephone and going to the PA. Moreover, a clear pattern can be seen: the younger is the citizen, the more digital is the chosen channel.

From here and on, the second part of the survey is described. This part, related to the Collaborative Procedure Designer, was different depending on the user taking the survey. We will focus first on citizens: these participants viewed first a mock-up video with a citizen leaving a suggestion on a bureaucratic procedure using the CPD¹².

¹²Citizenpedia CPD citizen mockup - <https://youtu.be/tZbwD8vPx-E>

Table VIII: Preferred channel to contact a civil servant, from the answer *I contacted with civil servants* to the question *When suffering from any of the previous problems, where did you find help*

Youngsters	Middle Age	Elderly	Response
26.68 %	31.52 %	56.30 %	Going to the PA buildings
40.05 %	31.64 %	25.02 %	Telephone
6.67 %	5.27 %	6.16%	Internet
26.60 %	31.58 %	12.53 %	Other channel

After that, we asked whether the concept was clear to the participants.

Results for the understanding of the CPD with citizens are shown in Table IX. Overall, the younger citizens were the ones to better understand the concept. In contrast, less than 40% of the elderly participants did not fully understand the steps of a flowchart.

Table IX: Answers to: *In the flowchart, are you able to distinguish the internal procedure from the interactions with the citizen?*

Youngsters	Middle Age	Elderly	Response
90.48 %	76.36 %	61.82 %	Yes, I understand who does each of the steps
9.52 %	23.64 %	38.18 %	No, I dont have a clue

In the case of the civil servants, the mock-up video showed how a civil servant revised the comment left by a citizen in the CPD¹³. After that, we asked the participants to empathize with the citizens, and to think what would be best from their opinion.

Results for this question are shown in Table X. In order to suggest enhancements, the favourite channel does not depend on the age . The favourite one is leaving comments in the flowchart. Sending e-mails and posting questions are also frequent choices.

Table X: Answers to: *Imagine you were a citizen: you find something that should be improved or modified in the flowchart of a procedure. What would you do?*

Youngsters	Middle Age	Elderly	Response
73.81 %	60.00 %	43.64 %	Leave a comment in the flowchart
26.19 %	25.45 %	34.55 %	Post a related question in the Q&A portal of Citizenpedia
23.81 %	27.27 %	25.45 %	Send a message/e-mail to the civil servant who created it

The final part of the questionnaire included a free-text field where the users could leave their comments and impressions. From the comments of the citizens we gathered that the elderly group should be taken into account in terms

¹³Citizenpedia CPD civil servant mockup - <https://youtu.be/rXbV9wQcxmo>

of usability and the simplicity of the PA content. Furthermore, smartphones should be considered as an important interaction channel to perform tasks inside the digital world nowadays. As a result, we should take into consideration the limitations of these devices.

In contrast, civil servants feedback poses a different point of view: most of their comments described how the systems should be, with their stakeholders in mind. In particular, most the comments where gathered from civil servants in the Galicia region, where most PA users are elderly people. We grabbed two main conclusions from their comments: first, the system should be simple and it should use symbols/pictures easy to recognize. We want to highlight a suggestion by a civil servant, who encouraged us to follow the already existing notation in physical public administrations due to its ease of recognition. The second conclusion, beyond the IT tasks, is that we should invest time and effort in the training citizens, especially the elders, to bring them close to new technologies, in this case Citizenpedia.

V. THE CITIZENPEDIA ARCHITECTURE

Having gathered the user’s feedback from the surveys, we designed the software architecture for the Citizenpedia. In this section we describe the different software components that form the framework block by block. Some of the components are required by the QAE and the CPD to work, but they are not directly exposed to the user. The overall architecture figure is depicted in Figure 1.

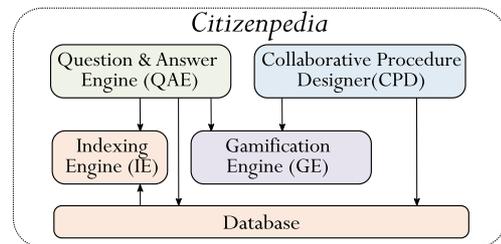


Figure 1: Internal software architecture

The green block in the figure represents the QAE, whose functionality has been described in Section III-A. Driven from the evaluation we explained in the previous section, we adopted a simple user interface and responsive web interface. Several participants of the surveys, especially elderly ones, reported to consider Citizenpedia a good idea but only if it was intuitive to use. On the software side, we constructed the QAE based on the already existing PaizaQA¹⁴.

The blue block in the figure represents the CPD, whose functionality has been described in Section III-B. As well as for the QAE, a responsive and easy to use web interface was implemented. On the software side, the CPD is composed of

¹⁴PaizaQA - <https://github.com/gi-no/paizaqa>

a server side that uses the Vert.x framework¹⁵, and a client side developed as an Angular2 web application¹⁶.

The orange blocks in the figure cover the storage of the information. The main piece of this module is the database. In the current version of the Citizenpedia we use MongoDB. The other piece is the indexing engine, which handles text-based queries in the QAE. This block has been deployed as an ElasticSearch¹⁷ engine.

The purple block in the figure represents the gamification engine. Each time a user performs an action, e.g. answering a question, it is registered in the gamification engine, and its reputation skill is computed. To this end, we use the SmartCampus¹⁸ gamification engine.

As a final note, the source code of Citizenpedia is publicly available as a github repository¹⁹.

VI. CONCLUSIONS

In this work we have presented the Citizenpedia, a human computation framework aimed at supporting the e-government domain. The Citizenpedia is composed of two web-based applications: the Question Answering Engine and the Collaborative Procedure Designer. The former is a place where citizens and civil servants can post and solve doubts about e-services and the PA, and the latter is a tool where citizens can collaborate with civil servants in the definition and improvement of new administrative procedures and e-services.

We have evaluated the design of the Citizenpedia using online surveys. These surveys contained some mock-up videos and a set of questions, and they were distributed among three regions in three different countries. They were filled by 152 citizens and 63 civil servants, and from the results we gathered that the overall idea of the Citizenpedia was successful among the participant, but that several aspects had to be taken into account.

The next steps will be, first, the development of new features in the Citizenpedia to improve its functionality. Next, we will conduct a user-based evaluation of the Citizenpedia in order to gather the impressions of the current software.

ACKNOWLEDGMENT

This work has been financially supported by the European Commission under the Horizon 2020 funding programme, project SIMPATICO (H2020-EURO-6-2015, grant number 692819).

¹⁵Eclipse Vert.x - <http://vertx.io>

¹⁶Google Angular2 - <https://angular.io>

¹⁷ElasticSearch - <https://www.elastic.co/products/elasticsearch>

¹⁸SmartCampus Gamification Engine - <https://github.com/smartcommunitylab/smartcampus.gamification>

¹⁹Citizenpedia source code repository - <https://github.com/SIMPATICOProject/citizenpedia>

REFERENCES

- [1] A. J. Quinn and B. B. Bederson, "Human computation: A survey and taxonomy of a growing field," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI '11. New York, NY, USA: ACM, 2011, pp. 1403–1412.
- [2] L. Von Ahn, "Human computation," Ph.D. dissertation, Pittsburgh, PA, USA, 2005, aAI3205378.
- [3] A. J. Quinn and B. B. Bederson, "Asksheet: Efficient human computation for decision making with spreadsheets," in *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*, ser. CSCW '14. New York, NY, USA: ACM, 2014, pp. 1456–1466.
- [4] E. P. P. Pe-Tham, D. H.-L. Goh, and C. S. Lee, "A typology of human computation games: an analysis and a review of current games," *Behaviour & Information Technology*, vol. 34, no. 8, pp. 809–824, 2015.
- [5] J. Prpi, A. Taeihagh, and J. Melton, "The fundamentals of policy crowdsourcing," *Policy & Internet*, vol. 7, no. 3, pp. 340–361, 2015. [Online]. Available: <http://dx.doi.org/10.1002/poi3.102>
- [6] K. McNutt, "Public engagement in the web 2.0 era: Social collaborative technologies in a public sector context," *Canadian Public Administration*, vol. 57, no. 1, pp. 49–70, 2014.
- [7] M. Thalos, "Who will advise us?" *SATS*, vol. 16, no. 1, pp. 67–95, 2015.
- [8] Y. Charalabidis, A. Triantafillou, V. Karkaletsis, and E. Loukis, "Public policy formulation through non moderated crowdsourcing in social media," in *Proceedings of the 4th International Conference on Electronic Participation (ePart 2012)*, Kristiansand, Norway. Springer Berlin Heidelberg, 2012, pp. 156–169.
- [9] Y. Charalabidis, E. N. Loukis, A. Androutsopoulou, V. Karkaletsis, and A. Triantafillou, "Passive crowdsourcing in government using social media," *Transforming Government: People, Process and Policy*, vol. 8, no. 2, pp. 283–308, 2014.
- [10] A. Asquer, "Not just videogames: Gamification and its potential application to public services," *Digital Public Administration and E-Government in Developing Nations: Policy and Practice*. [Online]. Available: <https://ssrn.com/abstract=2429345>
- [11] S. K. Bista, S. Nepal, C. Paris, and N. Colineau, "Gamification for online communities: A case study for delivering government services," *International Journal of Cooperative Information Systems*, vol. 23, no. 02, p. 1441002, 2014.
- [12] T. Dargan and F. Evequoz, "Designing engaging e-government services by combining user-centered design and gamification: a use-case," in *Proceedings of The 15th European Conference on eGovernment ECEG 2015 University of Portsmouth*, 2015, p. 70.
- [13] P. Engiel, R. Araujo, and C. Cappelli, "Designing public service process models for understandability," *Electron. J. e-Government*, vol. 12, no. 1, pp. 95–111, 2014.