ISSN: 2230-9926

*Available online at http://www.journalijdr.com*

IJDR

*International Journal of Development Research*
*Vol. 12, Issue, 07, pp. 57570-57573, July, 2022*
*https://doi.org/10.37118/ijdr.24979.07.2022*

RESEARCH ARTICLE OPEN ACCESS

# EVALUATION AND APPLICATION OF CROWDWORKING CONCEPT IN ELECTRIC UTILITIES

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## ARTICLE INFO

***Article History:***
Received 17th April, 2022
Received in revised form
26th May, 2022
Accepted 11th June, 2022
Published online 28th July, 2022

***Key Words:***
Crowdworking; Shared Economy; Economy App; Meter Reading.

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## ABSTRACT

With the spread of internet use, labor has been affected by new technologies, drastically changing the way people perform their work activities, with various significant effects in the most diverse sectors of society. This paper presents partial results of project "PD-00390--1090/2020 - Application and Evaluation of the concept of Crowdworking in the Electric Power Distribution Sector", of ANEEL's Brazilian R&D Program, aimed to experiment and model the concept of Crowdworking for the electricity distribution sector. The projects consist of conducting a pilot in the concession area of Enel in São Paulo to evaluate impacts and behaviors.



**Citation:** ***Diogo Serra Baldissin, Marcelo AparecidoPelegrini, Juan Carlo Mendes, Lucas Magon Santos et al.*** "Evaluation and application of crowdworking concept in electric utilities*", International Journal of Development Research*, 12, (07), 57570-57573.

# INTRODUCTION

One of the biggest transformations in the world of labor in the last decade has been the emerging digital online work platforms. This new way of working not only disrupted existing business models, but also the employment models on which these business models were based (BERG et al., 2018). While many sharing economy platforms started in the United States, sharing has become a global phenomenon, both because of the expansion of platforms to other countries and because the idea of sharing was welcomed around the world (SCHOR, 2011). The concept of sharing economies is broad enough to include systems for utilizing idle resources for consumption, such as the Airbnb community (dedicated to the commercial exploitation of empty rooms and apartments for travelers around the world), as well as including sharing systems goods for collaborative production, such as Wikipedia (dedicated to build the world's largest open encyclopedia). What these consumption and production systems have in common is the existence of an architecture for connecting subjects via the Internet and overcoming traditional business and work models, characterized by verticalization and rigid organizational structures (ZANATTA, 2017). Creating a definition for Crowdworking, also called the Sharing Economy, is challenging, given the enormous diversity among the activities practiced in its context and the limits of the relationship between participants (KITTUR, 2013). In this project, Crowdworking was defined as activities that involve completing tasks through online platforms that put various organizations and individuals in contact with other organizations and individuals through the Internet, allowing consumers and workers from all over the world to come together. Since 2005, Amazon Mechanical Turk has provided tasks that computers were unable to perform to crowdworkers. The workers receive micro rewards for solving data analysis problems, survey responses, and content moderation (HOWCROFT, BERVALL-KAREBORN, 2019). From this experience, the concept of Crowdworking spread to different economic segments. In the private sector, one can notice numerous companies that use the sharing economy model. However, there were no examples of applications in the Electric Sector. In this context, this project aimed to investigate the application of the concept of Shared Economy (Crowdworking) in the Electricity Distribution segment, including model design,

computational platform development, practical applications, and evaluation of technical and economic impacts.

***Crowdworking Application:*** The development of this project was motivated by the search for answers, from practical demonstrations and evaluations that aimed to investigate whether minimal tasks present in the sectoral activity can be performed by professionals on demand at a modest cost, without the loss of quality required by society. The construction of the project approach was initiated from ENEL's internal studies regarding the possibility of applying the Crowdworking concept in its activities, aiming to narrow costs with low criticality and dangerous activities through Collaborative Economy, such as meter reading and client's disconnection. Initially, a scope of 25 (twenty-five) services that could be associated with a Crowdworking Platform were mapped, in order to bring possible benefits to the electricity sector.

***Crowdworking Model:*** The Crowdworking Model describes aspects such as economic rules, relationship between Crowdsourcer and Worker, degree of centralization, degree of control over activities, balance of gain between the parties, governance form of the platform, communication strategy, technical, operational, and legal risks. We evaluated those aspects by developing a pilot test. We provided services to selected Workers for a period of two months. The concept applied in this work was based on Kittur et al. (2013), where the authors design the current process of Crowdworking as a market that can be visualized as a distributed computing system in which each person is analogous to a processor that can solve a task that requires human intelligence for its accomplishment. As shown in Figure 1, each activity that needs to be performed by a human being is linked to a Worker via an application for mobile devices. As an output of this process, there is the accomplishment of the task and the reward for the worker. The complexity of applying the Crowdworking model lies in the definition of roles associated with each stakeholder. Howcroft and Begvall-Kareborn (2019) use this relationship to typify forms of Crowdworking.

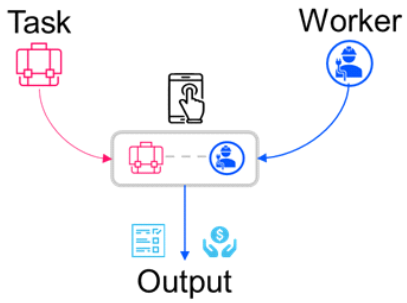



**Figure 1. Crowdworking Concept**

Based on this vision, the most similar typology applied in the project would be the so-called "Asset-based Services" or hyper-outsourcing. Activities are based on assets, crowdsourcer offers paid work and the service is initiated by the worker. They usually demand the use of physical assets such as bicycles, vehicles, available rooms, etc. However, there is a different aspect when dealing with the utilities model. A Crowdworking platform of this typology has its tasks requested by the end customer, which does not reflect the scenario faced by energy companies that have routine activities which in many cases do not involve requestsby customers. As we faced this reality in this project. We created specific design of procedures for managing tasks, as shown in Figure 2. The existence of interaction with the customer, mostly due to the provision of services at the customer's request, implies a change of responsibility in the validating activities. Activity validation leads to rewarding the Worker. The concept of Crowdworking seems simple at first glance, if we consider only the vision presented previously in Figure 1. However, it presents a series of characteristics that must be defined a priori from the technological definitions. In particular, as it deals with relationships between people, the establishment of rules and responsibilities is the basis for the design of the model.

***Crowdworking Platform:*** The Crowdworking Platform is a set of software components that connects the individual interested in completing tasks with the sourcer that needs to provide the service. It has two essential components: the mobile application and the architecture of integration between systems that allows the business rules of the platform to be applied. The application is the user's (Worker) way of selectingtaks and rewards for completing their work. This development forwards user requests to the system (Back End) and presents the results of each action. The Back End of the platform guarantees the application of business rules such as the services availability, tasks status and the receipt of rewards, among other actions inherent to the Collaborative Economy. Figure 3 shows the user interface for interacting with the platform, in order to choose a task, the meter reading proccess, sending a photo and completing the task.

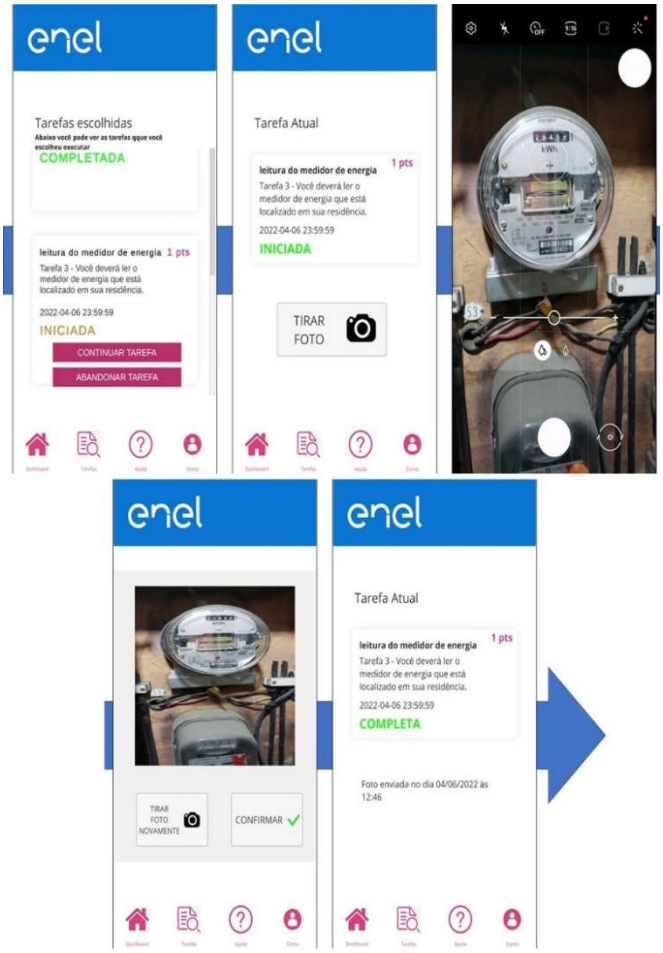
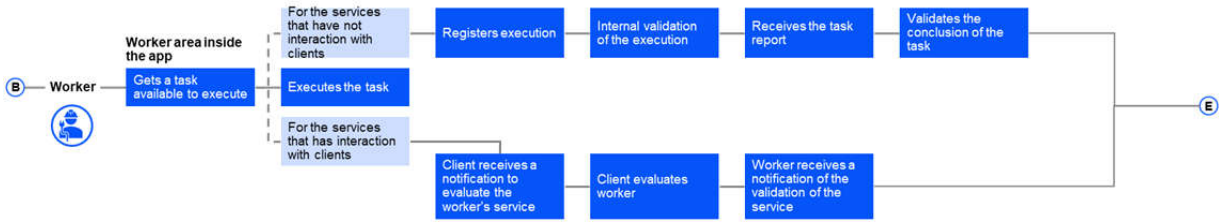



**Figure 3. Crowdworking Platform**

# METHODOLOGY

***Pilot Test:*** We designed the pilot test to meet the evaluation requirements of the Crowdworking concept. From recruitment, 10 volunteer users were given unique tasks over a period of 8 weeks to complete them and receive rewards for their accomplishment. In advance, we defined the number of unique tasks as well as its calendar. Tasks were made available for a period of 24 hours. After this period, the task was considered incomplete. One of the requirements of the Crowdworking Platform is that the the tasks area completed within this period. If not, the task returns to the list of tasks performed by the contractor. The rule is necessary to ensure that there is no breach of service deadlines, especially those requested by customers. We selected meter reading as a task to test in the pilot. The reading is done through a photo taken by the Crowdworking Platform that is later evaluated by the project team, to control to the quality of the result. The reading values must be readable.




| APP logins per week | SCORE |
|---|---|
| 5 days | 4 |
| 3 to 4 days | 3 |
| 1 to 2 days | 2 |
| Not once | 1 |

| Services execution | SCORE |
|---|---|
| 10 services | 4 |
| 8 to 9 services | 3 |
| 4 to 7 services | 2 |
| Up to 3 services | 1 |

| Services acceptance | SCORE |
|---|---|
| 10 services | 4 |
| 8 to 9 services | 3 |
| 4 to 7 services | 2 |
| Up to 3 services | 1 |

**Figure 2. SCORE Methodology**

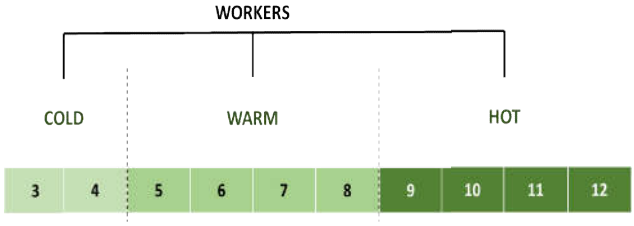



**Figure 3. Workers Clusters**

Within the context of the project, we chose this task because it has minimal interaction or proximity to the grid, being considered safe for users with basic training to perform the task. The pilot duration was 8 weeks. For its execution schedule, a duration of 10 weeks was used, being the first week for onboarding of Workers and training of volunteers, and one at the end for closing the pilot's activities. The pilot started in the first week with the objective of finishing the organization of the test execution by preparing the users to receive tasks in the first week of part 1 of the Experiment. Between the end of week 4 and the beginning of week 5, an engagement experiment was performed to assess the impact of engaging users. In the ninth week, the pilot was completedby closing the relationship with participants. The distribution of tasks throughout the week was created to allow analysis of aspects such as frequency, quantity performed on the same day and availability on weekends, in order to verify whether these issues impacted the interest of users. One of the great challenges in creating a shared economy community is keeping users active and engaged in completing tasks. In order to monitor user behavior, a methodology was created to assign a score (SCORE) and classify each worker. This Methodology estimates a score to the user's performance. We use the score to classify and qualify users in the program. As shown in Figure 4, when accessing the plataform and performing services throughout the week, the user receives different scores.

Based on the score received, we classify the users into 3 clusters:

- **COLD:** user with low productivity and performance on the platform
- **WARM:** average performing user
- **HOT:** user with high performance, performs practically all the actions offered by the platform

By evaluating the workers' scores, we defined engagement communications to test the weigh of direct notiffications in performance. Interactions with users were made directly through a messaging smartphone app, applying standardized messages for each group. We applied a different strategy for each group. Hot users received one message highlighting their good performance. Warm users received two messages. The first one encouraging the users to plan their day to perform more tasks. Two days later, we sent a message highlighting that in that specific week, the plataform would make available several tasks for the user. For the last group, the cold users, they received three messages focusing in engaging by introducing earnings they could achieve by returning to the platform.

# RESULTS

By developing the pilot, we identified relevant requirements to design the Crowdworking programs. Over the eight weeks of testing, there was a 23% reduction in the number of tasks performed by workers when comparing the first week with the last week of testing. During the entire pilot, we made available 800 reading tasks. About 55% of the tasks were completed. Regarding the execution days, it was possible to notice that on weekends and holidays the completion of tasks was significantly lower than those performed on working days. We also evaluated the quality of the the tasks performed in the pilot. Workers sent 440 photos of reading meters. Quality control evaluated each image by conducting a qualitative analysis to approve the readings. The main requirement applied was to verifiy if it was possible to identify the readings and numbers displayed. We had about 78% of precision, meaning that 43% of task were successfully completed. We started with twelve volunteers. Three of them left the program, two during training phase and one during the pilot. The last one was considerd out of program by not performing tasks over more than a week. Thus, we had 83.3% participation at the beginning of the programa and 75% by the end of the 8 weeks. The group of ten volunterees started completing taks. Only one volunteer had its average score assigned in COLD standard, while 50% remained in WARM for most of the test and the other four users in HOT classification. As for the engagement test, it was possible to notice a growth of 29% after receiving notifications to encourage the completion of tasks between the fourth and fifth week. After this period, the performance of tasks fell again, stabilizing at 49% until the end of the test.

# CONCLUSION

The application of the Crowdworking concept in the Electric Sector is motivated by the possibility of reducing costs, increasing the quality and productivity of activities, and adapting work to new models adopted in other economic segments. The pilot test results demonstrated the average task performed by workers on the platform (55%), their ability to achieve the proposed objective and quality (78%) and their need for engagement to maintain their status as active in the Crowdworking program, 29% growth resulted from engagement notifications. These results may serve as a basis for further and broader studies for the designing of specific programs to the electric sector in Brazil. Future works could explore several issues to complete these studies. Larger and regional samples would expand the vision of the behaviour of Brazilian crowdworkers in the sector, testing other services of the 25 tasks list can evaluate quality and impacts to the utilities and customers. Elasticity of rewards can be evaluated to identify balance between earnings and quality of activities. Risks and benefits can be surveyed to complete the business analysis. Lastly, simulating the design of different configurations for programs based on sensitivity analysis of costs, performance and benefits would aid the Crowdworking community of the sector.

**Acknowledgments**

This research was funded and supported by ANEEL's Brazilian R&D Program and ENEL. We thank our colleagues from ENEL who provided insight and expertise that greatly assisted the research and project PD-00390-1090/2020: Aplicação e Avaliação do conceito de crowdworking no setor de distribuição de energia elétrica.

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