# Quantitative Analysis of Zambian Wikipedia Contributions: Assessing Awareness, Willingness, Motivation, and the Impact of Gamified Leaderboards and Badges

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**Abstract.** Wikipedia is a widely recognized and valuable source of information, However, it encounters persistent challenges in attracting and retaining active contributors. It is recorded that only 10 people from Zambia contribute and create content on wikipedia in the month of may 2023. while a large number consumes Wikipedia content, there is a noticeably low number of Wikipedians that contribute content on and about Zambia. This paper presents a Facebook plugin, WikiMotivate, aimed at motivating Zambian Wikipedians to update pre-existing content, add new entries, and share their natural expertise. WikiMotivate was implemented as a Facebook plugin that utilizes leaderboard and badge gamification features to encourage and incentivise active Wikipedia content contribution. Using a mixed-methods approach, historical Wikipedia edit histories were used to quantify content contributed by Zambian Wikipedians. In addition, user surveys were conducted to determine relative levels of awareness about Wikipedia, willigness to contribute to contribute content on Wikipedia and perceived motivating factors that affect content contribution on Wikipedia. Furthermore, a Facebook plugin, WikiMotivate, was implemented in order to be used an a service for motivating potential Zambian Wikipedians. Finally, in order to determine the most effective approach, a comparative analysis of leaderboards and badges was conducted with nine (9) expert evaluaters. The results clearly indicate that a significant proportion of Wikipedia content on and about Zambia is authored by Wikipedians from outside Zambia, with only 11% of the contributors, out of the 224, originating from Zambia. In addition, study participants were largely unaware of the various editing practices on Wikipedia; interestingly enough, most participants expressed their willingness to contribute content if trained. In terms of motivating factors, "Information Seeking and Educational Fullfilment" was as the key motivating factor. The Facebook plugin implemented suggests that incoporating leaderboards and badges is a more effective approach to motivating contributions to Wikipedia. This study provides useful insight into the landscape of Wikipedia content contribution in the Global South.

## 1   Introduction

Digital content contribution from contributors originating from countries located in the so-called Global South is noticeably low, with a recent study by Graham et al. reporting that Sub-Saharan Africa stands out with the lowest levels of participation on GitHub—1% of GitHub users hail from the region—and shocking low levels of Wikipedia contributions, with contributions originating from the whole of Africa being lower than those from Hong Kong [7]. Interestingly enough, of the Wikipedia articles on and about Africa, only 5% of the contributions were reported to have been generated locally [7]. Recent statistics on Wikipedia contributions suggest that Wikipedia content contribution participation from the so-called Global South is still low.

While there are a considerable number of Global South Internet users that consume content from Wikipedia, there is a corresponding disproportionate number of users that contribute content to the same platform. The Republic of Zambia provides a classic case example for this problem; for instance, there were a total of 2,347,000 Wikipedia page views against a mere 20 editors from The Republic of Zambia in the month of April 2024[1].

The motivation for conducting this is three-fold; first, there is a reported disproportionate content on Wikipedia on about the Global South; second, statistics compiled by Wikipedia indicate that there is a vast difference between Wikipedia content consumption and creation in the Global South [8]; finally, with the rapid adoption of Large Larguage Models (LLMs), such as ChatGPT [17],it becomes crucial to ensure that data sources used to train the LLMs are updated with content from underrepresented regions of the world. Incidentally, Wikipedia is reported as one of the well-know pre-training and fine-tunning dataset for most LLMs [15,11].

This paper presents work conducted to explore how gamification could be utilised in order to increase the number of Zambian Wikipedians with the potential to increase content creation and contribution. Specifically, the study was guided by the following specific objectives:

- To quantify Wikipedia content creation and contribution about Zambia by Zambians
- To determine the levels of awareness and willingness to create and contribute content on Wikipedia
- To identify the perceived motivation factors that affect content contribution on Wikipedia
- To design and implement a software that will use gamification to motivate and increase content creation and contribution on Wikipedia

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[1] https://stats.wikimedia.org/#/metrics/en.wikipedia.org

The remainder of this paper is organised as follows: Section 2 is a review of existing literature related to the study conducted; Section 3 describes the methodological approach followed when executing the studies linked to this research; Section 4 presents study findings and their discussions and; finally, Section 5 provides concluding remarks.

## 2   Related Work

### 2.1   Wikipedia Content Contribution Awareness, Willingness and Motivation

Several studies have been conducted to understand the willingness and motivations linked to contributing content on Wikipedia. The motivations linked to content contribution can, in part, be best understood using existing theories on motivation; there are a series of theories that explain the factors that drive and direct human motivations. Popular theories include Maslow's Theory of Hierarchical Needs [25], Hertzberg's Two-Factor Theory [2], McClelland's Theory of Needs [23], Vroom's Theory of Expectancy [24] and McGregor's Theory X and Theory Y [12]. In addition, the Uses and Gratification Theory [3,10] has been applied extensively in understanding content contribution.

Xu and Li's empirical study revealed that Wikipedia content contribution is largely driven by extrinsically oriented motivations, including reciprocity and the need for self-development [26]. Yang and Lai set out to determine how conventional and self concept-based motivation on individual willingness affect the sharing of knowledge in Wikipedia, with internal self-concept motivation identified as the key motivation for knowledge sharing on Wikipedia [27]. Crowston and Fagnot argue that motives for contributing content differ at various stages [5].

The study presented in this work extensively used the Uses and Gratification in order to understand how digital content contribution gratifies users due to its successful application in prior studies [20,4]. For instance .

### 2.2   Quantifying Digital Content Contributions

There have been a number of studies conducted to empirically analyse various aspects of Wikipedia. Reagle [21] and Ortega [18] both conducted studies focusing on quantitative analysis of Wikipedia, aimed at measuring various aspects of the Wikipedia platform in order to gain insights into its collaborative nature. These studies utilised large datasets of user-contributed data from Wikipedia, including article edits and revisions. The quantitative studies measured engagement and impact within the Wikipedia community, analysing factors such as the number of edits, revisions per page, and user distribution to uncover patterns of contribution and participation. Ortega's work, in particular focused on identifying the fraction of authors responsible for most changes in Wikipedia articles and how their behavior evolved over time.

Some existing works have explored the measurement of user participation on digital platforms, with Riquelme and Gonzalez [22] investigating the factors influencing participation levels on Twitter using user activities and contribution patterns.

### 2.3   Gamification for Enhanced User Engagement

Gamification has been reported to increase motivation and participation during crowdsourcing, with different implementations using a combination of simpler implementations such as point system and other richer mechanisms [14].

Studies specific to Wikipedia include work by Eisenschlos et al. [6] in which a gamification framework used badges and reputation systems to motivate users to create and contribute high-quality content. Oceja and Sierra explore how the presence of tangible rewards vs. badges impacts the user's behaviours, with tangible rewards proving to be more effective [16].

The work presented in this paper focuses on the use of leaderboards and badges and is aligned with work by Katz and Suleman as the Facebook platform is used as the primary platform for users to engage [9].

## 3   Methodology

This research study employed a mixed method approach, blending both qualitative and quantitative research methods to provide a more comprehensive understanding of the study. A total of three (3) sub-studies were conducted. First, an empirical study involving the analysis of Wikipedia edit histories for pages on and about Zambia was conducted as outlined in Section 3.1. In addition, a survey, outlined in Section 3.2 was conducted to determine the levels of awareness of Wikipedia content contribution; perceived willingness to contribute content to Wikipedia; and perceived motivation factors linked to Wikipedia content contribution. Finally, Furthermore, a Facebook plugin was then implemented, as outlined in Section 3.3 and subsequently evaluated.

### 3.1   Quantifying Wikipedia Content Contributions

In order to determine the relative quantity of Wikipedia content contributed by Zambians, Wikipedia edit history records were extracted and analysed from Wikipedia. Wikipedia page with content on and about Zambia were purposively sampled. The total number of contribution was used as an inclusion criteria.

The history view page of the candidate pages served as the measurement instrument. In essence, data of both user account editors as well non-user editors (anonymous editors) was collected from the history view page of the pages quantified. Registered user contributions have a corresponding hyperlinked username for the contributors, with the hyperlink leading to the profile page of the contributor. Anonymous contributions on the other hand, have the IP address associated with the contributor. Figure 1 shows an example history view page for

**Fig. 1.** Revision History for Zambia Wikipedia Page

the Zambia Wikipedia page. The history entry highlighted in the red bounding box shows a sample contribution from a registered user "Maximajorian Viridio", while the history entry highlighted in black bounding box shows a sample contribution from an anonymous contributor.

The data collection process involved retrieving IP addresses from editors without Wikipedia user accounts, identified as IP accounts, through the Wikipedia view history of pages relevant to Zambia. The IP addresses were then used to determine the origin of the editors in order to assess the level of engagement. For editors with user accounts, the procedure involved a manual retrieval of their origin information by checking their biography on Wikipedia.

As shown in Figure 1, Wikipedia contributions are of varying types, including additions and deletions of content; the magnitude of the contributions represented in terms of bytes. The definition of a contribution in the study presented in this paper was agnostic of the type—addition or deletion—and size.

### 3.2   Levels of Awareness, Willingness and Motivation Factors

The goal of assessing the level of awareness and willingness was to measure the level of awareness and willingness among individuals from Zambia to participate in content creation and contribution on and about Zambia-related articles on Wikipedia. Furthermore, the aspect of the study linked to motivating factors was focused on determining factors with the potential to motivate content contribution on Wikipedia.

Study participants were randomly sampled from The University of Zambia (UNZA) students and informed Zambian employees were the target population for assessing the level of awareness and willingness to create and contribute content on Wikipedia about Zambia.

Online Google Forms[2] questionnaires were used to collect data on their perceived awareness and willingness to contribute content to Wikipedia. The questionnaires included items for assessing awareness, willingness and, additionally, subjective views on motivating factors aligned with the Uses and Gratification

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[2] https://www.google.com/forms/about

**Table 1.** Awareness, Willingness and Motivation Questionnaire Items

| Aspect | Items | Scale |
|---|---|---|
| Demographics | Age | Interval |
| | (Student/Employee) Gender | Categorical |
| | Level of Study | Categorical |
| | Year of Study | Categorical |
| | (Employee) Highest Qualification | Categorical |
| | (Employee) Profession | Categorical |
| | (Employee) Geographic Location | Categorical |
| | (Student/Employee) Experience Editing | 5-Point Likert Scale |
| Awareness | Editing content on Wikipedia | 5-Point Likert Scale |
| | Anonymously editing on Wikipedia | 5-Point Likert Scale |
| | Contributing minimal edits on Wikipedia | 5-Point Likert Scale |
| | Creating a new article on Wikipedia | 5-Point Likert Scale |
| | Adding multimedia on Wikipedia | 5-Point Likert Scale |
| | Processes and guidelines for Wikipedia | 5-Point Likert Scale |
| Willingness | Willing to contribute content on Wikipedia | 5-Point Likert Scale |
| Motivation | Information Seeking & Educational Fullfilment | 5-Point Likert Scale |
| | Self-Expression & Identity | 5-Point Likert Scale |
| | Social Interaction | 5-Point Likert Scale |
| | Achievement and Recognition | 5-Point Likert Scale |

Theory [20]. The questionnaire was designed to include the items summarised in Table 1

### 3.3   Design, Implementation and Evaluation of WikiMotivate

The WikiMotivate platform is a multifaceted Web application developed primarily using the Python programming language and the Flask Web framework [19]. Specifically, the XTools API [1] to retrieve data about top editors, dynamically creating visually appealing leaderboard images, and seamlessly sharing these images on the dedicated WikiMotivate Facebook page. The integration between the WikiMotivate Web applicatoin and Facebook was facilitated using the Facebook Graph API [13].

WikiMotivate sends HTTP GET requests to the XTools API endpoint specific to each Wikipedia page, resulting in a response with data about top editors, edit counts and other relevant metrics. An additional feature facilitates the automatic generation of data and information for the leaderboard and badges. The badge and leaderboard specific information is then posted on a WikiMotivate

public Facebook page[3]. Facebook was identifed as an appropriate host environ-
ment as it is one of the most widely used social medial platforms in Zambia.

## 4   Results and Discussion

As outlined in Section 3, a total of three (3) sub-studies—outlined in Sections 4.1
to 4.3—were conducted as part of the research presented in this paper.

### 4.1   Quantifying Wikipedia Content Contributions

As of October 24 2023, there were 6,733,541 articles in the English Wikipedia, out
of which a total of 244 were identified as being related to Zambia. A total of four
(4)—Zambia[4], History of Zambia[5], Victoria Fall[6] and Economy of Zambia[7]—
Wikipedia articles were analysed during the empirical evaluation.
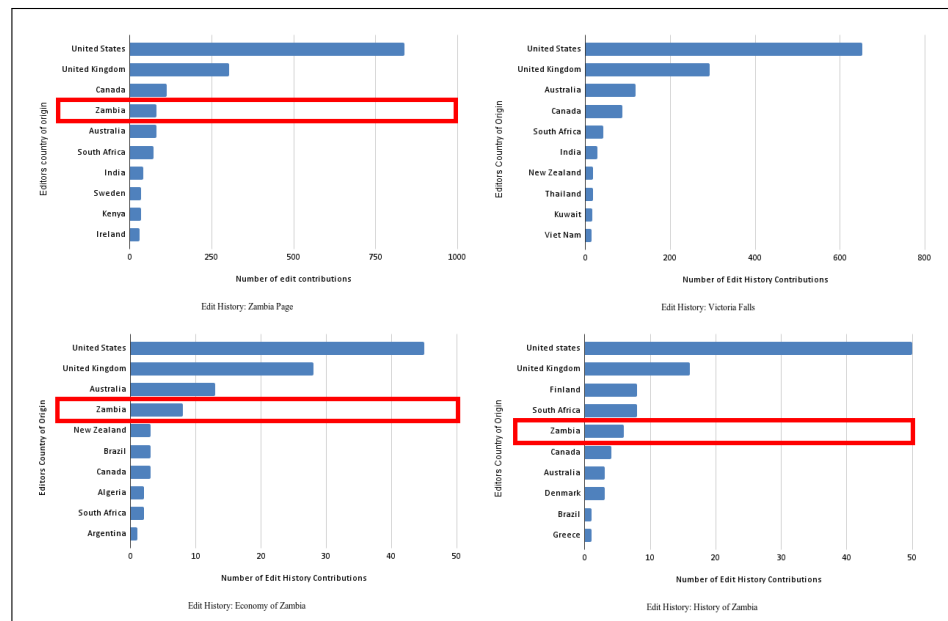


**Fig. 2.** Zambian Wikipedia Page Contributions (IP Addresses)

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[3] https://www.facebook.com/profile.php?id=100094560138473

[4] https://en.wikipedia.org/wiki/Zambia

[5] https://en.wikipedia.org/wiki/History_of_Zambia

[6] https://en.wikipedia.org/wiki/Victoria_Falls

[7] https://en.wikipedia.org/wiki/Economy_of_Zambia

**Analysis 1. Anonymous Contributions** Figure 2 shows the top 10 Wikipedia edit history countries by anonymous editors, with results for the Zambia, History of Zambia, Victoria Falls and Economy of Zambia Wikipedia pages. The results indicate that the United States is the source country with the highest number of edits for all the four (4) Wikipedia pages.

Surprisingly enough, Zambia is not on the top 10 list for the Zambia Wikipedia page, a Wikipedia page on and about Zambia with the largest number of edit histories. These results provide a compelling case for why the problem with the lack of active Zambia Wikipedians. Interestingly enough, Zambia is on the top 5 list of couries for the History of Zambia and Economy of Zambia Wikipedia pages. A potential explaination for this is arguably that the two pages fall within the category of pages that attract little interest from non-Zambian Wikipedians. This is in fact further supported by the results for the Victoria Fall Wikipedia page in which Zambia is the country with the least Wikipedians in the top 10 list.

**Analysis 2. Registered Users' Contributions** The contributions from registered users are summarised in Figure 3 and Table 2. The contributions from Zambia are not on the top 10 list of contributions for the "Economy of Zambia" and "History of Zambia" Wikipedia Pages. Interestingly enough, the total contributions from Zambia are the highest for the "Zambia" Wikipedia page, however, upon further analysis, it was discovered that there were a number of contributors who had contributed significantly more. This is in fact illustrated in Table 2 were the total number of contributors from Zambia were a mere 14, accounting for 11%.

An analysis of overall contributors from Zambia presents a compelling case for how serious the problem of few Global South contributors. Out of the 224 contributors of the four (4) Wikipedia pages analysed, a mere 18—representing 8%—were identified as originating from Zambia. A further breakdown of this distribution highlights the severity of the problem; the proportion of contributors from Zambia for the "Zambia", "History of Zambia", "Economy of Zambia" and "Victoria Falls" pages was 11% (14 out of 124 contributors), 3% (1 out of 39 contributors), 3% (1 out of 34) and 7% (2 out of 27 contributors), respectively.

### 4.2   Levels of Awareness, Willingnesss and Motivation

As outlined in Section 3.2, the second objective was aimed at determining the levels of awareness of content contribution on Wikipedia, perceived willingness to contribute content on Wikipedia and, additionally, identifying motivating factors that could encourage content contribution on Wikipedia. Online surveys were used in order to elicit responses.

**Demographic Factors** A total of 60 participants responded to the Employee questionnaire, with varying values for gender, education qualifications, ages, professions and geographic locations. 82 students participants responded to the Stu-
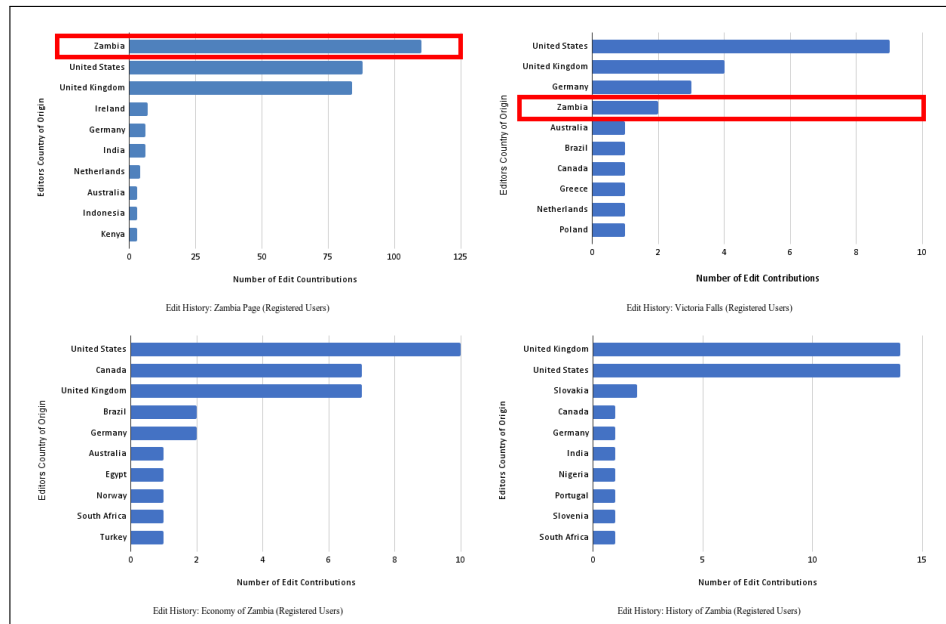
**Fig. 3.** Zambian Wikipedia Page Contributions (Registered Users)

dent questionnaire with varying gender, age, level of education, year of student
and experience with Wikipedia.
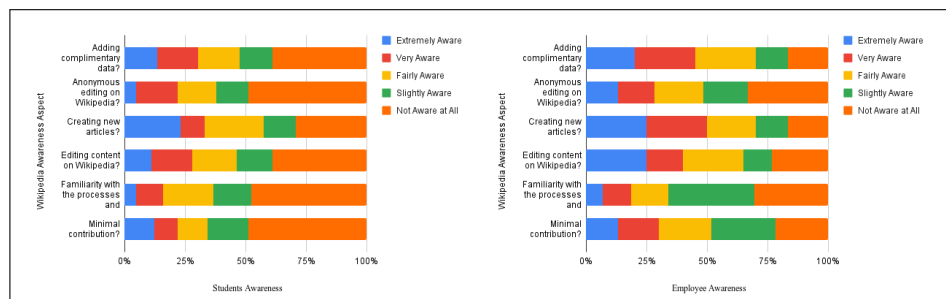


**Fig. 4.** Survey Participants' Perceived Levels of Awareness

**Analysis 1. Awareness** The results suggest that the awareness levels for em-
ployees are more than that of students. Figure 4 shows plots of results for relative
levels of awareness for Employees and Students.

While most students were aware that articles can be created on Wikipedia
(71%), there levels of awareness regarding processes and procedures (52%),

**Table 2.** Top 5 Contributors and Contributions by Country

| Page | Country | Contributors | Contributions |
|------|---------|--------------|---------------|
| Zambia[a] | United States | 44 | 88 |
| | United Kingdom | 17 | 84 |
| | **Zambia** | **14** | **204** |
| | Canada | 7 | 9 |
| | Germany | 6 | 6 |
| History of Zambia[b] | United Kingdom | 14 | 14 |
| | United States | 14 | 14 |
| | Slovakia | 2 | 2 |
| | Canada | 1 | 1 |
| | Germany | 1 | 1 |
| Economy of Zambia[c] | United States | 10 | 10 |
| | Canada | 7 | 7 |
| | United Kingdom | 7 | 7 |
| | Brazil | 2 | 2 |
| | Germany | 2 | 2 |
| Victoria Falls[d] | United States | 9 | 9 |
| | United Kingdom | 4 | 4 |
| | Germany | 3 | 3 |
| | **Zambia** | **2** | **2** |
| | Australia | 1 | 1 |

[a] https://en.wikipedia.org/wiki/Zambia

[b] https://en.wikipedia.org/wiki/History_of_Zambia

[c] https://en.wikipedia.org/wiki/Economy_of_Zambia

[d] https://en.wikipedia.org/wiki/Victoria_Falls

anonymous editing (51%), minimal contribution (51%) and editing content (61%) were lower. The awareness levels for employyes on the other hand were generally higher, with the highest awareness levels related to creating new articles (83%) and adding complementary data (83%), and the lowest being familiarity with processes (70%).

**Analysis 2. Willingness** Figure 5 shows the relative levels of participants' willingness to contribute content to Wikipedia. The results are very encouraging a significant number of both Students (96%) and Employees (100%) expressed their willingness to contribute content to Wikipedia. Surprisingly enough though, a lot more Students (4%), when compared with Employees (0%) were less willing to contribute content. These findings are further supported by the participants' general comments presented in "Analysis 4. Participants' Remarks" section. The
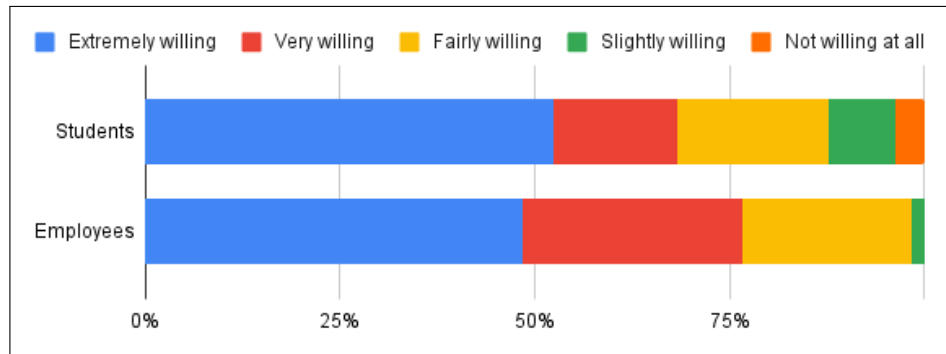
**Fig. 5.** Survey Participants' Perceived Willingness to Contribute.

implications of these findings are significant: they suggest that with proper training and awareness, content contribution on and about Zambia on Wikipedia can potentially increase.
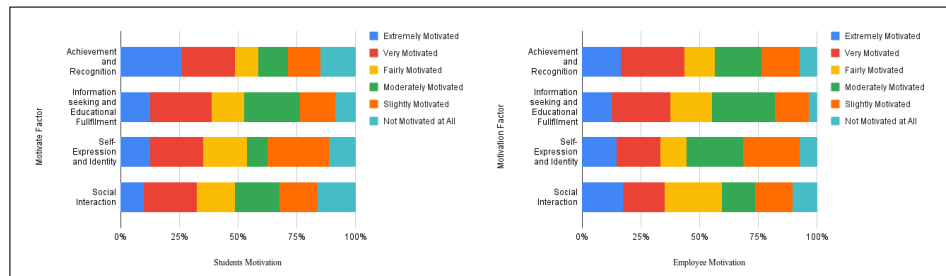


**Fig. 6.** Survey Participants' Perceived Motivation Factors.

**Analysis 3. Motivation** Figure 6 shows the relative levels of motivation for Students and Employees, respectively. Interestingly enough, for both Students and Employees, most of the participants indicated that all the various motivation factors were strong motivation factors. The "Information Seeking and Educational Fullfilment" factor was identified as the most prominent factor for both Students and Employees. Additionally, "Social Interaction" was identified as the least likely motivation factors for both Students and Employees.

These results, and especially findings linked to the "Achievement and Recognition" motivation factor, suggest a potential for gamification to be used an a tool to encourage Wikipedia contributions.

**Analysis 4. Participants' Remarks** A thematic analysis of the open-ended comments provided by the participants identified "lack of awareness and knowl-

edge", "willingness to participate", "motivations for contribution", "challenges and concerns", "general perceptions of Wikipedia" and "suggestions for improvement". Some of the remarks provided by the participants are as follows:

"I was not aware of that one could actually create content and contribute to platforms like Wikipedia. Being able to contribute on such platforms will lead to more innovativeness and enable people to share information and knowledge easily." [Student 7]

"I have not created anything on Wikipedia but am willing to learn on how to do it and would like to express myself with such a platform" [Student 8]

"My enthusiasm on wikipedia platfom is there and me knowing that people can contribute and edit articles it gives me a level of understanding were i can't regard wikipedia for my academic writings because some of the information is not clearly explained " [Student 11]

"I wasn't aware, but I would love to create content" [Student 13]

"I'm more than willing to participate in creating content on Wikipedia but the major challenge is I lack knowledge on how to go about the process" [15]

"As a country we are very behind in terms of documenting our story. The collection and preservation of information for posterity is very crucial to enabling future generations to have a fair understanding of what has been in the past. A platform like Wikipedia is the perfect platform to document the history of men and women that have shaped our society and also to give insight into what is and what makes Zambia what it is. Therefore, enhancing the capacity of people to create and add content on Wikipedia is a very big step in the right direction." [Employee 12]

"people aren't even aware that we can edit or even add to wikipedia content" [Employee 27]

"I have little information on content creation on Wikipedia but I am willing to learn once a platform is established. I would love my company to advertise its products and services on Wikipedia." [Employee 45]

### 4.3   Design, Implementation and Evaluation of WikiMotivate

Figure 7 shows the Web application interface, while Figure 8 shows a screenshot of the WikiMotivate Facebook public page automatically populalted with gamified posts of various Zambian Wikipedia page used during the experiment. The toolkit was successfully integrated with Facebook, with edit histories automatically synchronised from the Wikipedia pages.

The WikiMotivate software was evaluated to determine whether the leaderboard, the badge, or both might capture users' attention, keep it, and inspire them to consistently provide new content to Wikipedia. The majority of the study participants indicated that the WikiMotivate toolkit positively influenced their motivation to contribute content. In addition, the vast majority of paticipants indicated that combining a leaderboard and badges was more effective that using either leaderboards or badges in isolation. Some interesting participants' general comments were as follows:
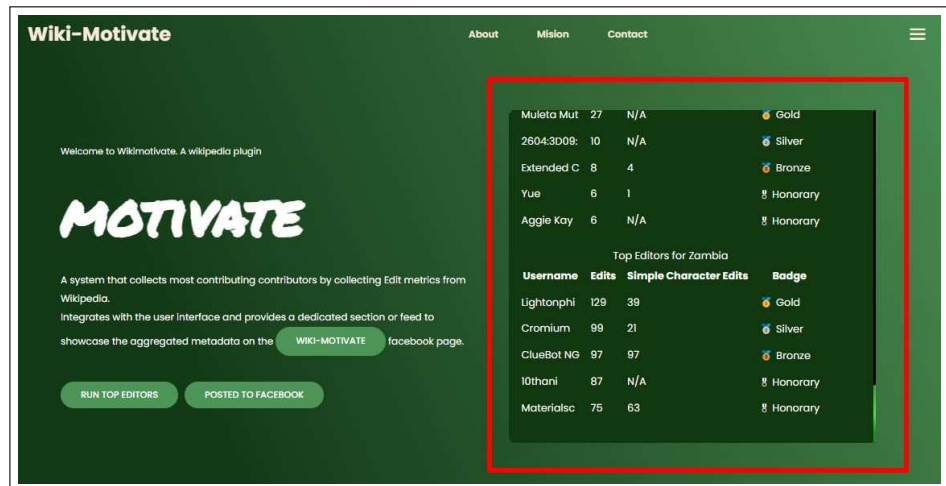
**Fig. 7.** Screenshot Showing WikiMotivate Leaderboard and Ranking of Top Editors
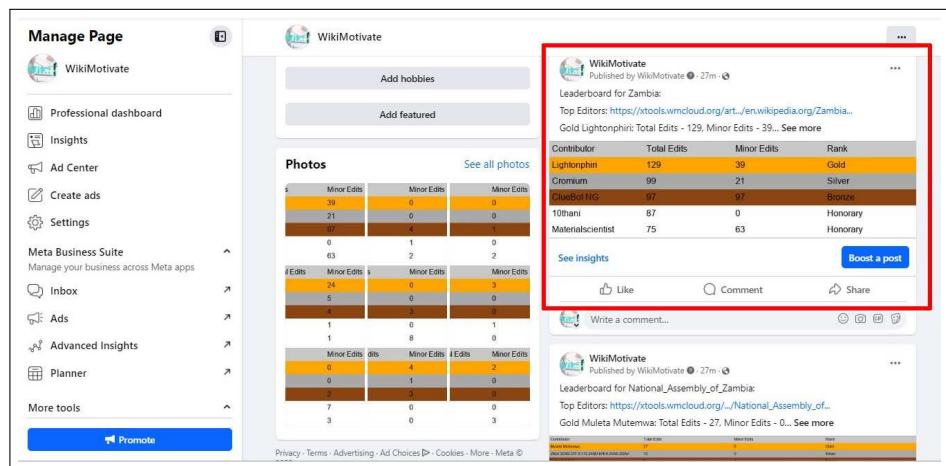


**Fig. 8.** Screenshot Showing WikiMotivate Top Editors Posted to Facebook WikiMotivate Page

"The system was really motivating. I enjoyed seeing my name on the leader-board" [Participant 3]
"This software has really given me a reason to edit more and more content" [Participant 7].

Both comments from [Participant 3] and [Participant 7] suggest that the software has the potential to be very impactful.

## 5    Conclusion

This paper presented studies conducted in order to understand the historical contributions of Wikipedia contributions originating from Zambia. While four (4) Wikipedia pages were purporsively sampled, the results can arguably generalised, as indicated by the common patterns in the results. Significantly, the quantitative analysis highlights the problem with few Wikipedians from Zambia. The study aimed at determining the awareness, willingness and motivation factors sheds light on the relative levels of awareness, willingness and motivation factors associated with editing content on Wikipedia by potential Zambian Wikipedians; the results suggest that the levels of awareness are significantly low, however, most participants were willing to contribute content. The results further suggest that intrinsic motivation factors have a potential to increase contributions from Zambian Wikipedians. Finally, the implementation and use of the WikiMotivate Facebook plugin demonstrates how software tools and services can potentially be used to encourage contributions to Wikipedia.

Potential future work could involve a large-scale nation-wide survey to further understand how the different demographic factors influence willingness and motivation. In addition, future work could explore the use for more widely used services such as WhatsApp through the use of WhatsApp bots.

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