Challenges and Opportunities in University-Based Humanitarian Mapathons: Enhancing Citizen Science Contributions to Open Spatial Data

Jakub Trojan [1], Tereza Srnečková [1]

[1] Faculty of Logistics and Crisis Management, Tomas Bata University in Zlín, Studentské nám. 1532, 686 01 Uherské Hradiště, Czech Republic – trojan@utb.cz, t_srneckova@utb.cz

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Abstract

Citizen science has become a key paradigm for the creation and improvement of digital geographic data, especially in areas often neglected by commercial mapping initiatives (Vohland et al., 2021). University mapathons are an important tool for engaging students in humanitarian mapping and have the potential to contribute significantly to the quality and quantity of volunteered geographic data as a gathering place for a particular community interested in self-development and contributing to society-wide development. This paper analyses the complex aspects related to the organisation and implementation of mapathons in a university setting, focusing on a case study of Tomas Bata University in Zlín.

1. Introduction

Citizen science is an important method of obtaining scientific data through public engagement. Although various forms of citizen science have existed for centuries, the term itself was introduced in the 1990s and has since gained popularity due to technological advances and current trends in society (Haklay et al. in Vohland et al., 2021). Currently, there is no fixed definition or framework for citizen science. The definitions and frameworks that do exist and are adopted by different actors are often imprecise and allow for loose interpretation with a focus on specific areas or goals. However, there is general agreement that the active involvement of the general public in some part of scientific research is crucial (Haklay et al., 2021). Precisely because of the difficulty of defining citizen science, it is often referred to or confused with participatory science, amateur science, crowdsourced science or public participation in scientific research (Haklay, 2015)

Although citizen science is a phenomenon of the last few years (Strasser et al., 2019), its principles have been used since before the term was coined. It has a long history in the fields of meteorology, ornithology, and astronomy, but in recent years it has also been used, for example, in biochemistry and other scientific disciplines (Cooper, 2018). Today, the recognition of citizen science is growing in science, policy, education, and wider society, establishing itself as both a research field and a practical discipline (Trojan et al., 2019). Citizen science promotes collective endeavour and changes the imperial approach to scientific research that has been the standard to date (Cooper, 2018). National and global associations (e.g., the European Citizen Science Association - ECSA - in Europe) and portals dedicated to citizen science, where projects can be found and engaged with, have had a significant impact on the growth and influence of citizen science. At a global level, the SciStarter platform (https://scistarter.org) or Zooniverse (https://www.zooniverse.org) work very well. In Europe, EU-Citizen.Science is widely popular (https://eu-citizen.science./).

Given the increased attention in recent years, citizen science is taking shape and becoming more concrete. Depending on this, one can foresee developments that may also aim at changing it altogether in the future. In North America, for example, the term “citizen science” is already being replaced by “participatory science”.

In the context of geographic data, citizen science plays a particularly important role in areas characterised by rapid urbanisation, humanitarian crises or environmental vulnerability, where up-to-date and accurate spatial information is crucial for effective planning, disaster response and sustainable development (Goodchild, 2007, See et al., 2025). One of the most important projects in this area is OpenStreetMap (OSM), a free and open geographic database of the world that allows anyone to contribute to the creation and updating of maps (Mooney & Mingini, 2017; OpenStreetMap, 2025).

An effective and rapidly expanding approach to improving the world map in OpenStreetMap is the so-called Mapathons (Quill, 2018). These are a specific format of community mapping where volunteers from different backgrounds come together to map a specific area using satellite imagery or aerial photography. The Humanitarian OpenStreetMap Team (HOT) has created a dedicated Tasking Manager, an online platform for coordinating mapping in response to humanitarian crises. This platform allows for the distribution of mapping tasks among volunteers and provides a systematic approach to mapping priority areas (Institute for Global Sustainable Development, 2023).

2. Mapathons in a university environment

Universities are ideal environments for organising mapathons for several reasons. They have the necessary technical infrastructure, such as computer labs and high-speed internet connections, and they also concentrate young people who are often motivated to contribute to global issues. In addition, the academic environment fosters critical thinking and rigor, qualities that are key to quality mapping.

To organize a successful mapathon, it is important to understand the characteristics that influence participation and productivity. An analysis of eighteen public mapathons in Brno showed that the month of the event has a significant impact on the number of participants. These findings are valuable for planning future mapathons to maximize participation (Štampach et al., 2021).

University mapathons usually follow a standardized format (Fig. 1):

- An introductory presentation about the purpose of the mapathon and the target area.

- Creation or verification of user accounts on the OpenStreetMap platform.
- Selecting a mapping task in the HOT Tasking Manager.
- Training on basic mapping techniques.
- Custom mapping with support from more experienced mappers.
- Final reflection and discussion on the benefits of mapping.

Figure 1. Journey of a university mapathon. (source: authors)

2.1 Motivation of mapathon participants

Understanding the motivations that drive university students to participate in humanitarian mapping activities is essential for designing effective recruitment and retention strategies. Research conducted by Štampach et al. (2021) identified six strong motivating factors. Half of them were related to altruism and the other half were related to the importance of the OpenStreetMap project and the mapping community.

Participants often reported feeling a sense of humanitarianism due to their contribution to communities in need. The social aspect is also important, with a large percentage of participants reporting that mapathons are fun and that they have learned something new, for example by improving their digitization skills or that humanitarian organizations need help (Štampach et al., 2021).

A critical, but still understudied aspect of keeping participants engaged is the use of narrative methods to enhance intrinsic motivation. In this context, storytelling appears to be a potentially promising method. Not only are participants interested in the quality of the completed task, but they are also inspired to perform and engage in other activities with a similar story with which they can emotionally identify. This emotional connection significantly increases the level of commitment and persistence of mapping over time (Richter et al., 2019).

2.2 Technical Aspects and Challenges of Mapathons

One of the significant limitations of current mapathons is the size restrictions on changesets for new OSM contributors, which are designed to ensure data quality but potentially hinder the productivity of large-scale mapathons. At the end of January 2024, the OpenStreetMap API introduced a limit on the number of changes that new users are allowed to make. A new user can only upload 1000 edits per hour during their first day of using OSM, which is roughly equivalent to adding 200 square buildings. This limit gradually increases in a non-linear fashion up to 100,000 edits per hour during the first week (HeiGit, 2024).

Various approaches to address potential vandalism and ensure data quality are discussed in the OpenStreetMap community. Some suggestions include an account level system where users would gain higher levels based on approval of their change sets by more experienced users. For example, users at level 1 would have limits on the size of the area (max. 5x5 km in one changeset), the number of changesets per day (max. 10), and the number of features that can be deleted (max. 25) (OpenStreetMap Community Forum, 2023).

2.3 Software tools for mapping

Another technical aspect is the choice of a suitable software interface for mapping. The iD web editor is widely used due to its simplicity and accessibility, but has limited functionality compared to the desktop application JOSM (Java OpenStreetMap Editor). JOSM offers many keyboard shortcuts and plug-ins that speed up otherwise repetitive processes, such as redrawing all four corners of each building or drawing buildings one by one. The editor also offers more powerful validation tools to ensure edits are accepted. Another significant advantage of JOSM is its ability to work offline, which is useful in environments with less stable internet connections or lower bandwidth (YouthMappers, 2021).

The basic modes of operation of the two editors are similar. Both allow adding, deleting and editing elements based on the OSM data model and adding tags or attribute information to these geographic elements. In iD these elements are referred to as points, lines and areas, while in JOSM they are referred to as nodes, paths and sessions. The terminology of iD is more familiar to those who have experience with GIS, while JOSM is more familiar to those who are familiar with the OSM data model (YouthMappers, 2021).

2.4 Effect of geometry of mapped objects

This paper also discusses the effect of geometry and complexity of vectorized objects on the efficiency and accuracy of mapping. Specifically, it discusses the relative challenges associated with mapping different feature types such as roads (linear features), buildings (polygonal features), and land use areas (polygonal features), and how these geometric characteristics affect the overall mapathon workflow (Skarlatidou et al., 2024).

Different features have different accuracy requirements and mapper experience, with some features being easier for beginners and vice versa. Appropriate choice of mapping tasks can contribute to better participation and overall efficiency of geographic data production. For example, mapping buildings often requires careful contouring of rectangular shapes, while mapping roads can be easier due to their linear nature (Green et al., 2019).

3. Case study: mapathons at Tomas Bata University

Tomas Bata University in Zlín (UTB) is a representative example of a regional university deeply involved in community and regional development initiatives. The Faculty of Logistics and Crisis Management (FLKŘ) of UTB regularly organises mapathons in cooperation with Doctors Without Borders. Students are actively involved in humanitarian cartography, contributing to better availability of geographic data in crisis areas. The mapathons have been running since 2019 and in total more than 300 students have participated. After each mapathon, semi-structured interviews are conducted with selected students to identify the reasons for their motivation to participate in the mapathon, or to get feedback on limitations and constraints encountered during the mapping process. Responses tend to be very similar to what Štampach et al. (2021) found, with increasing criticism of the limitations of the number of changesets recorded. The interviews further suggest that the variables listed below are key (see also Fig. 2):

- Number of participants and their previous mapping experience: if participants have mapping experience from previous mapathons, they perform better (both qualitatively - i.e., lower proportion of invalidated changesets and quantitatively.
- Type of objects mapped (buildings, roads, water bodies, etc.): participants clearly find mapping buildings to be the easiest (especially using plugins in JOSM if they already have experience with JOSM), despite the fact that OSM contributors often find it easier to record paths.
- Time spent mapping each object type.
- Number and type of errors identified during validation.
- Subjective assessment of task difficulty by participants.

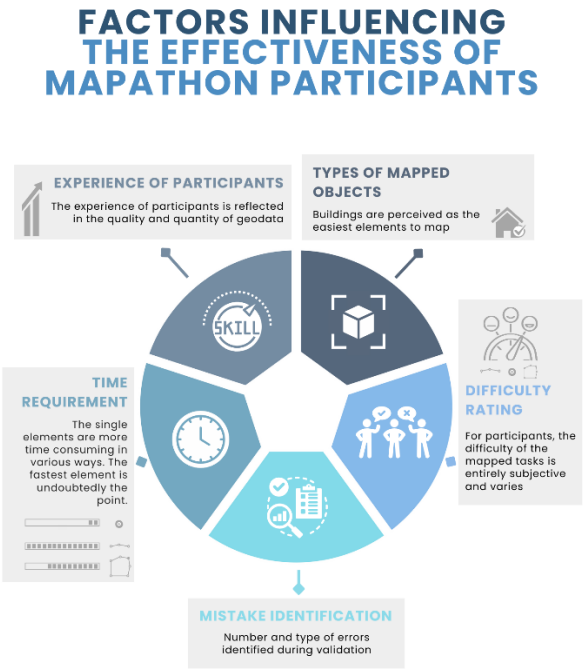

Figure 2. Factors influencing the effectiveness of mapathon participants. (source: authors)

Interview results further suggest that well-structured mapathons, coupled with robust community engagement strategies, can significantly increase both the level of student engagement and the overall scope and quality of volunteered geographic information (VGI). Analysis of data from mapathons at UTB confirms that through the coordinated engagement of large numbers of participants over time, mapping has a significant impact on humanitarian action in vulnerable places on Earth. An example of this is the participation of students in a mapathon (see Fig. 3), which managed to cover approximately 90% of the target area in the Bahr El Ghazel region of Chad (task ID 18359), equivalent to approx. 30 km², in just two hours. (UTB, 2025). This result is positive as these were mostly novice mappers who showed interest in further mapathons.

Structured university mapathons can also achieve significantly higher element completion rates and lower error rates compared to ad hoc mapping efforts, especially when incorporating targeted training components. For example, participants who received structured introductory training had a 30% lower error rate in building mapping compared to those who began mapping without a formal introduction. (Štampach et al., 2021).

Qualitative research based on input from communication partners identified several key factors that contribute to the success of university mapathons:

- Clearly linking mapping tasks to specific humanitarian needs strengthens participants' motivation (consistent finding with Štampach et al., 2021).
- Structured training at the beginning of each event significantly improves the quality and quantity of data generated (identical finding with Institute for Global Sustainable Development, 2023).

- The social aspect of mapathons promotes participant engagement and retention.
- Appropriate choice of mapping tasks, taking into account the experience level of participants, optimises the effectiveness of the process.

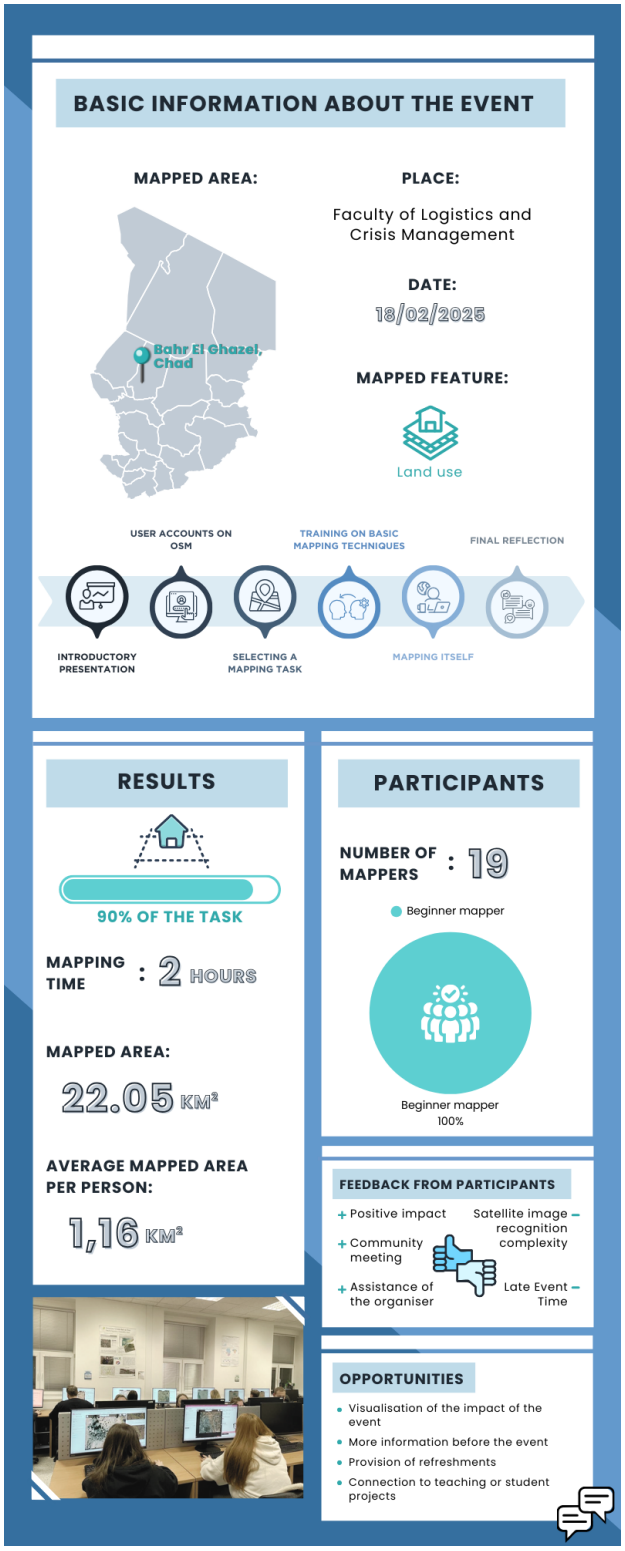

Figure 3. Summary of the organised university mapathon. (source: authors)

In relation to the use of storytelling in the mapathon of 18.2.2025, the semi-structured interviews showed that the presentation of the area and its issues left a deep impression on the participants and aroused greater motivation to participate in the next mapping event. Participants were introduced to the issue of commercial maps, the lack of maps in developing areas, the whole process of providing aid (which will be part of it) and then the mapping event itself, which focused on mapping the Bahr El Ghazel area in order to organize a diphtheria vaccination campaign. Both the area itself and the disease diphtheria and its health complications and mortality statistics were presented. The presentation (see Fig. 4) was supplemented with dynamic elements to keep attention and photographs taken by Doctors Without Borders to provide more context to the humanitarian mapping and enhance understanding of its importance.

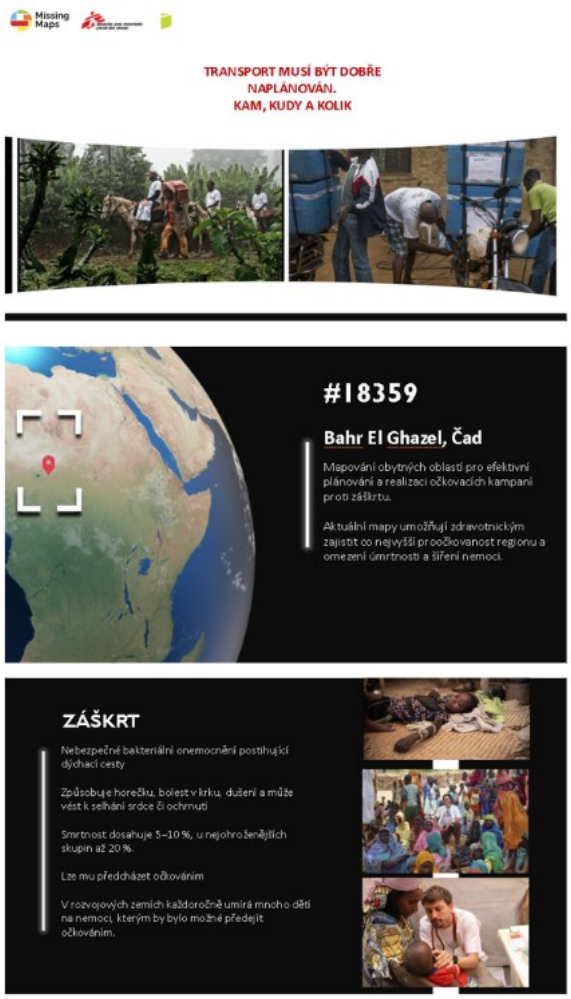

Figure 4. preview of the storytelling presentation for the Bahr El Ghazel mapathon at UTB. (source: authors)

The biggest challenge (encountered by the authors) for new mappers is clearly identifying features on satellite imagery, but this skill can be trained. This was initially quite demotivating for the participants, but the collective effort of communicating and questioning together did not deter the participants, and after the event they stated that they were able to recognize objects better as the number of identifications increased. Also, the possibility of communication and the assistance of the mapathon organizer during unclear tasks had a very positive impact on the whole experience of the event.

Some participants stated that they do not and probably will not engage in humanitarian mapping in their free time outside of mapathons organised on university, but that they would be happy to do so on the occasion of a university mapathon. This can be influenced by both setting aside and defining a space, which avoids distractions and loss of attention by surrounding oneself with other people and setting the atmosphere. Another important factor is the social aspect, which can be an important motivator that can be enhanced by creating a comfortable environment.

Limiting the size of change sets for new OSM contributors was also found to pose a significant challenge for large mapathons with many new participants, as confirmed by the HeiGiT analysis (2024). This limitation, although designed to protect data quality in OSM, can reduce the productivity and enthusiasm of new mappers

4. Conclusions

By carefully addressing the identified challenges and leveraging the inherent opportunities in the university environment, the contribution of citizen science to global geospatial data can be greatly enhanced, to the benefit of both the mappers themselves and the users of the collected data. University mapathons are an effective way to mobilize the collective efforts of students to address global challenges through the creation of open geographic data. These events not only provide valuable data for humanitarian organizations but also develop participants' technical and analytical skills and strengthen their awareness of global issues (Štampach et al., 2021).

Research on organised mapathons at the regional university UTB confirms the strength of the involvement of university students who, even as beginners, are able to cover a considerable territory. Universities are ideal places to create stable communities that perform periodic activities due to the constant influx of new students – thus individuals who lose interest or graduate can be replaced by new students and thus keep the mapping community active. The primary concern is to provide support for hosting these events and to generate motivation among students to attend.

Going forward, it is important to further develop methodologies to ensure the quality of data generated during mapathons, explore innovative approaches to motivate and retain participants, and look for ways to better integrate university mapathons into broader ecosystems of citizen science and open data. Particular attention should also be paid to overcoming technical barriers, such as restrictions on new contributors, that may prevent mapathons from reaching their full potential. The authors' next steps will be to develop and continue to organize university mapathons at Tomas Bata University, taking into account feedback from participants and related community building and raising awareness of humanitarian mapping.

This research contributes to the growing body of knowledge on participatory mapping methodologies while offering practical guidance for university mapathon organizers seeking to establish or improve humanitarian mapping initiatives within their institutions.

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Appendix

Data from the mapathon used as example in this article can be found under the project #18359 in HOT Tasking Manager. They are freely accessible.