Citizen Science with Resource-poor Farmers as a new Approach to Climate Adaptation and Food Security: Evidence from Honduras

M.Sc. thesis summary of findings
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Farmer in Honduras who participated in the research study. Credit: J. Steinke

This study contributes to the recently emerging body of knowledge about citizen science. It is the first scientific study about crowdsourcing agronomic data with smallholder farmers, and important conclusions for the development of Crowdsourcing Crop Improvement (CCI), but also for other, future, citizen science projects with farmers can be drawn. It was documented that CCI can produce scientifically robust results and relevant output for farmers in their pursuit of improved livelihood.

As was shown, the evaluative criteria chosen by researchers and extensionists for the Honduran CCI project were well selected. Just five out of the seven criteria accounted for about 66 % of preference criteria mentioned by farmers. This means that meaningful results can be generated even by restricting the variety evaluation to a manageable, low number of criteria. Although trait preferences and priorities differ at the individual level, and, more so, due to regional differences in environment, socio-economic context and cultivation history, it was possible to construct an adequate approximate consensus for smallholder farmers from four regions of Honduras. Along the research to this study, it became clear that yield stability is more relevant than increases in yield potential, which is why CCI should focus on selecting varieties that contribute to this objective.

While controversy about whether decentral, crowdsourced, citizen science is able to comply with ‘scientific standards’ is likely to never cease, this study evidences that farmers’ observations, on the whole, are not random, but accurate, at varying levels depending on the respective trait’s ease of visual observation. Farmer observation is, thus, a reasonable scientific method. With the detected levels of accuracy and the type of ranking observation requested in CCI, moderate and realistic numbers of observations are sufficient for significant distinction of crop varieties by Bradley-Terry models. This result is encouraging new applications of citizen science with farmers, as a method of highly client-oriented research. Ease of trait observation or, alternatively, specific basic training for observation, should guide the design of crowdsourcing projects with farmers.

Because participating in CCI in the setup presented in this study requires access to land, which is predominantly held by men in many places worldwide, gender equity is not in central focus. However, women are empowered by participating in women’s research

groups, and CCI represents an easy, low-threshold methodology for women to get involved in agricultural activities and research, and this way strengthen their position in the household as well as the rural society. Above all, women's and men's variety preferences seem to be equal in this study's context, which means that men's evaluations and variety selections in CCI can be expected to benefit rural women equally. This particular situation, however, may not be given in all locations, and a male majority in CCI may in fact lead to increased gender disparities elsewhere. Giving women farmers, but especially farmers' housewives, an adequate say in CCI must be an important goal in further implementations.

Farmers' engagement in citizen science was shown to be driven by rational motives, mainly by the pursuit of an improved livelihood and economic development of their community. Unlike in most other citizen science projects, fun is a negligible motive for most farmers. Yet when the possibility of improving livelihood is perceived, farmers are highly motivated to participate.

Three main incentives for participation were identified: Agronomic capacity building, the inherent access to new, adapted crop varieties, and the generation of social capital. The acquisition of skills and knowledge is not only likely to improve data quality and return rate, but was seen to be the strongest driver of farmers' engagement in citizen science, as an indirect lever of agricultural development. Therefore, if possible, citizen science with farmers should include elements of capacity building relevant to cultivation, in addition to the learning that comes with participating. This way, large numbers of farmers can be motivated to participate.

Useful insights were gained about opportunities and pitfalls of upscaling CCI from locally specific experiences to a scalable, generalised model. Although promoting the methodology with donors, local NGOs and rural grass-root organisations are strategies to involve additional actors to an existing project, the key to upscaling is likely to lie in automatising the process by two adjustments. Firstly, minimising the requirements of facilitation per participant by streamlining all steps of participation to maximum simplicity and clarity, and using mobile phone technology: For example, the observation card participants use to record their trial evaluations can be designed to be more accessible for farmers with restricted literacy, too. Initial training events may convey all capacity required for participation – yet if one event is not sufficient to create an adequate level of understanding, then the requirements need to be simplified, like adapting the evaluative criteria.

Secondly, it is suggested that the crowdsourcing project be constructed around specially trained local facilitators, who are incentivised to work towards quantity and quality of farmer participation by economic opportunities and personal benefits. These local facilitators, ideally lead farmers from rural communities, need to be given a protocol of activities they are responsible for, including the initial training workshop for first-time participants, data collection and passing on observation data to the project implementers.

This way, a crucial bottleneck of communication – between farmers in remote locations, and extensionists who need to spend resources on transportation and building trust – is avoided, and extensionists can focus on a manageable number of facilitators, who may be equipped with tablet computers, mobile phones and/or airtime credit, to facilitate communication and mutual data and information transmission.

Although subject to practical testing, massive upscaling of CCI seems feasible. Committed researchers and implementing bodies will always be key to a project's success, especially as

there can be no general scheme to implementation, and CCI will always need creative and flexible local adaptation. Nevertheless, this study shows that citizen science with farmers is viable, scalable, and yields robust and meaningful results. These results may be inputs to a large variety of potential new applications of thecrowdsourcing approach in agricultural and development research.

The results of this study allow the assumption that CCI has the potential to contribute to smallholder farmers' adaptation to climate change and their enhanced food security in regions of strong climate hazard. By further developing CCI as a flexible and scalable strategy, and with national or sub-national organisations taking a strong role in implementation, many farming households affected by climatic changes may get access to an array of better adapted cultivars, and are empowered to take effective adaptation decisions. In combination with the vital practice of conserving genetic diversity locally in community seed banks, overall levels of food security of rural families in times of climate change may be boosted, and climatic shocks can be mitigated. Stagnating yield levels and climate-related disasters are a common reality for resource-poor farmers in many parts of the world, while crop researchers often lack effective tools to distribute seed innovation beyond selected villages. Incentivising and promoting crowdsourced experimentation with a low capacity threshold and a wisely selected array of varieties currently seems the most promising strategy to provide a high number of farming households with the technology to meet their nutritious needs more reliably.

CCI projects need to be carried out in regions with a variety of climatic and socioeconomic conditions. This way, the results, i.e. the characterisation of a variety's optimum environment, can be shared with crop researchers and extension programmes worldwide, and synergies should be expected: By connecting the trials with environmental data from sources like remote sensing or networks or low-cost sensors (cf. van Duivendijk 2015), the varieties' suitabilities for similar environments around the globe may be predicted, cultural preferences let aside. If CCI and subsequent analysis is consequently enhanced by this feature, benefits will go far beyond the limited region of implementation, and climate adaptation through seed innovation is sped up at a global level.

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