How can geodata, crowdsourcing and artificial intelligence contribute to post-Covid resilience of food systems and communities?

Community of Practice meeting report
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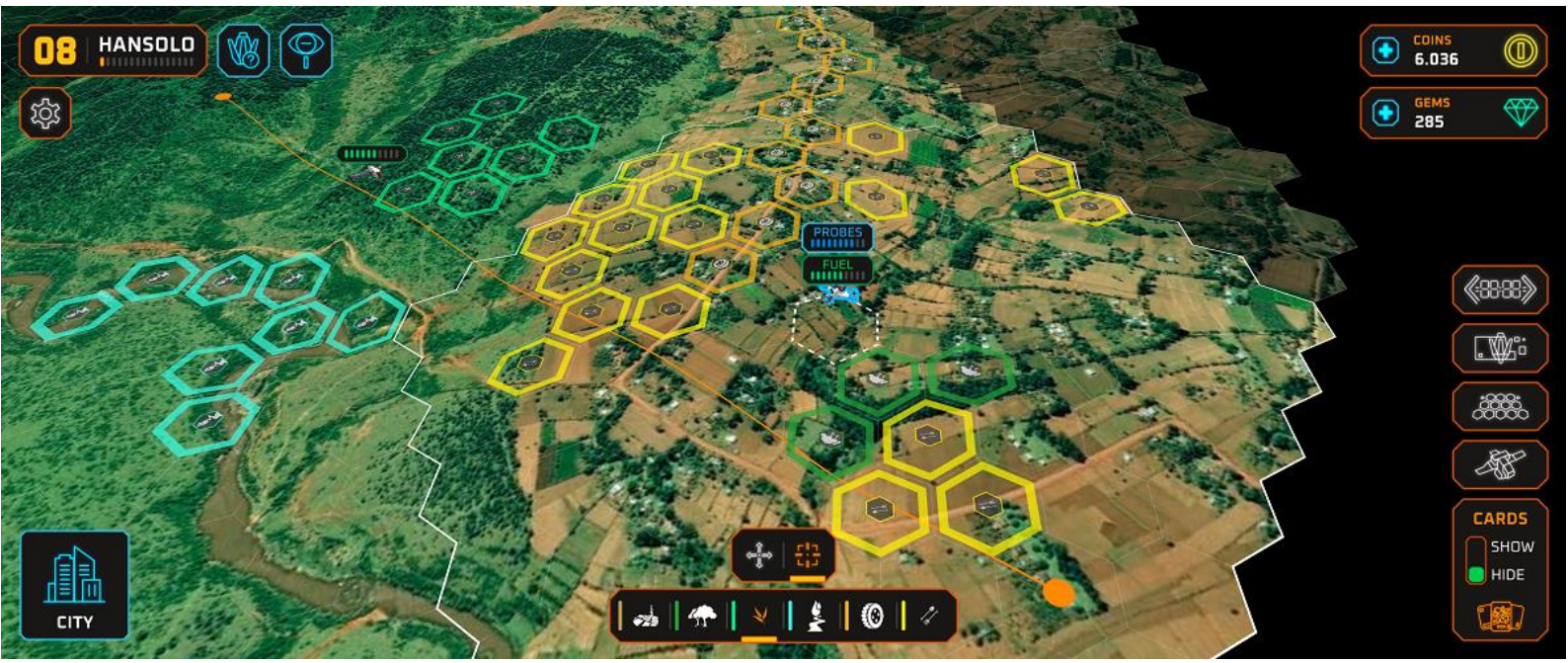
The Hague Centre for Strategic Studies, 52impact, BlackShore and Food & Business Knowledge Platform (F&BKP)



Context and goal of this CoP meeting

As the Covid-19 pandemic continues disrupting globally, it brings to light and exacerbates structural problems in societies and economies - resulting in reduced food and nutrition security, dropping demand for food, as well as income and job losses. Despite the devastating human toll, Covid-19's impact on conflict has so far been relatively small. Initially, the lockdowns enforced globally even caused a decrease in political disorder worldwide as large demonstrations stopped taking place - even if events of mob violence and state repression increased. But as the pandemic continues to impact societies worldwide, countering its impacts will become increasingly difficult as social, technical, and financial capital is becoming ever more strained.

As the crisis progresses, Covid-19's restrictions in food supply chains are expected to result in rising food prices in some countries. With incomes decreasing at the same time, households are faced with difficult decisions reducing both the quality and quantity of their food consumption. The latest State of Food Security and Nutrition in the World report warns that these effects of Covid-19 threaten to push an additional 83-132 million people into a state of chronic hunger. As pre-existing inequality and fragile institutions cause these effects to disproportionately impact those least able to manage, the risk of social unrest and violence rises in contexts when grievances about inequalities and inclusion already exist.

To mitigate this risk, The Hague Centre for Strategic Studies, 52impact, and BlackShore have started a European Space Agency-funded project to monitor the impacts of Covid-19 on food security and political stability via satellite data, crowd-sourcing and artificial intelligence. They were seeking feedback at this CoP to optimize the relevance of this initiative. The CoP meeting therefore took one of the pilot countries for this project - Ethiopia - as a case to see where such monitoring efforts are most relevant and how they can contribute to post-Covid resilience of food systems, value chains and communities. Ethiopia faced considerable challenges before the Covid crisis, most notably in the form of the Eastern Locust Crisis, rising food prices as well as its slow democratic transition. The purpose of the meeting was to target the project to deliver maximum benefits to the local population and relevance to stakeholders.

Presentation by Judith Jacobs - Wageningen Centre for Development Innovation

Please follow this link for the PowerPoint presentation.

Judith set the scene for the discussions by presenting the insights from a number of rapid assessments done by WCDI in Ethiopia. Rapid country assessments synthesized secondary data on impacts of the Covid-19 crisis to prioritize short term challenges and actions required in Ethiopia. A second set of assessments on the seed, fertilizer and sesame sectors were also done via focus group discussions with stakeholders. Link to assessments. Key findings included:

- GDP contributions from the agriculture sector (generating about 73% of employment) dropped by 5,2% in the first 7 weeks of the Covid-19 outbreak in Ethiopia.
- The national response strategy prioritizes crop production with a strong focus on cereals and cash crops. These are selected for their ease and reliability of production, export value or import substitution value, but not nutritional value.
- Due to mobility restrictions, casual labourers are not able to travel to places where work is available and a robust social safety net for these groups is lacking. Other severely affected groups are ultra-poor, acutely malnourished women and children.
- Availability of food is not yet an issue, but affordability is.
- Street vendors and small retailers are struck severely, as well as restaurant owners and transportation services.
- A financial action plan is needed for the sesame sector, institutions are holding back which is impacting sesame production. Farmers also switch to sorghum, so export of sesame - which is very important for Ethiopia's ability to import goods - is decreasing. While overproduction and price drops of sorghum can be expected, diminishing farmer income.

From this experience, implications for the monitoring of Covid-19 impacts on food security and political stability are:

- Do not isolate Covid-19 as a main shock. It is part of a new normal in addition to the desert locust plague, political unrest, weather impacts like heavy rainfall at the moment. These latter are impacting lives of people more than Covid-19 at the moment, according to stakeholders involved in the assessments.

- Think of ownership by local partners from the start of the project, many things are already happening - also in response to Covid-19. Identify local institutions as partners and link to what they are doing rather than doing a standalone exercise.
- Maybe monitoring can add to ongoing initiatives by including a focus on pro-active work: inform people to support their capability to anticipate and respond in the post-Covid recovery phase.

Presentation by Tomaso Ceccarelli - Wageningen University, Earth Observation and Environmental Informatics Division

Please follow this link for the PowerPoint presentation.

Tomaso presented the Innovation Recommendation Mapping (IRM) instrument, part of the BENEFIT CASCAPE and REALISE projects in Ethiopia. IRM started out as a scaling instrument for farming innovation within CASCAPE and is currently being embedded into local and regional level planning. The proof of concept was done at Woreda (district) level. Further applications (implemented, planned and intended) of the instrument include:

- Crop suitability assessment for credit support;
- Responding to food security questions at the regional level (with REALISE);
- Supply chain analysis, e.g. looking at sourcing optimization;
- Varietal screening (or crop 'migration') for changing climate conditions at local level;
- Advisory at the territorial level, with potential to expand to the farm field level.

IRM works by collecting, combining and translating information on 'best-fit innovations' with geodata, in combination with crowdsourcing into crop suitability maps and scenario set-ups. The process starts out by first collecting information about (best-fit) innovations, including crop types and farming technology, from projects and extension packages from the Ministry of Agriculture. Then key criteria from this data are selected for the model, which also includes biophysical data and geodata that is correlated to yields (land cover, crop type, rainfall, vegetation). As well as data on socio-economic feasibility (market access, and farm production feasibility - like access to inputs and travel time to farmer unions and extension centres). This is calibrated together with local experts and communities to create a dataset with final rules for the model. This model creates visual maps of suitability for certain innovations in certain areas, which is validated with local stakeholders (triangulation). From this process scenarios for project planning can be generated. Users can 'play' with the parameters, for instance by introducing new rural infrastructure to see how this affects the scenario - for instance by reducing travel time to extension centres. Or by seeing how the introduction of certain biofertilizers will impact yields. Relevant lessons from this process include:

- Crowdsourcing is about more than providing data input. Crowdsourced data, which comes from a multiplicity of local actors: extension workers, planners, leaders, researchers, agro-dealers, farmers, etc., are extremely important for "validating" (triangulating) estimates (e.g. travelling time) and the innovation, to calibrate the relevance of variables and to locate features and navigate a territory.
- Farmers (including those with limited degrees of literacy) are very knowledgeable and can identify locations and features on (complicated) A4 maps - as a form of "validation".
- Moving towards even better ways of visualizing objects and results could help a lot in participatory scoping and evaluation of the innovations. The project is currently investigating what would be the best way, e.g. cardboard 3D models or virtual 3D representations.

Since the COVID-19 crisis the project sought to apply the model to COVID-19 preparedness and response. It has developed scenarios to see how mobility restrictions would impact access to impacts at distribution sites and extension centres. The model was able to identify potential areas with poor access and create scenarios to inform how locations for new sites of agro-input distribution and extension can be optimized.

Presentation by the Crowds & Machines consortium members: Laura Birkman and Nino Malekovich from The Hague Centre for Strategic Studies, Koen Verberne from 52Impact and Hans van 't Woud from BlackShore.

Please follow this link for the PowerPoint presentation.

In order to come to a better grip of the interrelated challenges that COVID-19 presents, this consortium will develop a 'demonstrator' called Crowds & Machines (C&M), funded by the European Space Agency. The aim of the project is to demonstrate the feasibility of providing strategic information concerning the impact of COVID-19 on food security and political stability, enabling decision makers to track the impact of COVID-19, design scenarios and act upon those effectively. If successful, C&M will assist governments, NGOs and international businesses during the outbreak of COVID-19 and prepare for the post-COVID-19 period. The envisioned capabilities of this monitor are:

- Identifying geographic hotspot areas of risk worldwide and specifically in remote locations which are still difficult to map;
- Assessing the medium- to longer-term impacts of Covid-19 in relation to indicators for food insecurity and conflict-related events;
- Supporting the design of adequate and effective (policy) response mechanisms.

The project will use a combination of satellite data, crowdsourcing and machine learning. Crowdsourced analytics generate the training data for machine learning algorithms. (Open) satellite imagery will enable cost efficient global monitoring. And the enabling technologies of machine learning and causal modelling will enable the processing of large datasets to identify relations between variables.

Political instability monitor

Enhancements to the political instability monitor model of HCSS will enable the project to relate conflict risk to food insecurity and Covid-19 data. Currently the model predicts conflict probabilities at administrative district levels measured in months. 1700 governance, economic, social, demographic and conflict indicators are currently available for forecasting conflict risk with a selection of these indicators being the drivers of the performance. On the basis of this, HCSS is able to develop causal models of conflict risk that explain the nature of conflict and optimize possible conflict intervention strategies. The C&M project will build on this by including COVID-19 variables and food security variables to analyze how they contribute to conflict risk. Specific machine learning techniques such as reinforcement learning can be used to optimize how interventions will change the causal path that leads to conflict risk.

Satellites and crowds

Satellite data from 52impact will be used for seasonal food security monitoring and long term food security forecasting. With satellites, crops are identified, harvests assessed and land use maps generated.This is combined with models on climate and other indicators related to the landscape such as regional level water availability risks.

As input to the machine learning models of 52impact, labeled data needs to be generated. The challenge is that there is such a vast amount of data available that it is a hard job to analyze everything. Therefore BlackShore has started using human intelligence to turn satellite images into maps by letting people play a computer game where they look at this satellite data and get rewards for identifying features like roads and wells - this is then established on a map on the basis of consensus. The concept was proven in another project for an NGO in Mali, mapping farm fields to monitor positive economic impacts. The game currently has 53.000 players and is accessed via Windows, Google or as a community on Facebook. While the previous model generated maps, currently the ability to use crowd inputs to train computers in automatically detecting landscape features in maps is being integrated. Next steps are to acquire input from (potential) users, develop a first prototype of the system and test it in Ethiopia.

Key reflections in the discussion

The discussion that followed reflected on the three presentations and provided feedback on a number of key questions identified by the Crowds & Machines consortium - related to how such innovations can best contribute to resilience.

Where are the needs in monitoring food security & political stability impacts of Covid? (for policy – for practice?)

- A policymaker from the Dutch MFA underscores that in light of crisis prevention and resilience building information/predictions on what is coming up in (e.g.) the next 6 months is key for them to determine the right course of action. The key question for such monitors is: where are food insecurity and conflict going to happen?
- Other key information includes: 1) How are conflict-affected and stable areas going to evolve? 2) How is COVID-19 impacting certain regions? And, 3) Which parts of the population are the groups most affected by crises like COVID-19?
- An embassy staff member in Addis Ababa underscored that predictions of where insecurity is going to happen are particularly interesting, as it gives them time that is required to respond to changes in an adequate way in both humanitarian and development programming. Currently, adaptations in dairy, horticulture, productive safety net programmes are done with a lag. Such predictions would allow them to fall back on other partners, such as WUR-WCDI - which can then provide guiding principles and actions, but also to guide regional administrators or the national government on where to intervene and change policies.
- A practitioner from Mercy Corps confirmed that for a multi-mandated organization like theirs, such information would be very useful to implement integrated programmes that address both drivers of instability and food insecurity to build resilience.

What scale would be most interesting to monitor (and why)?

- An MFA policymaker and embassy staff member confirmed the ‘resolution’ of available information would be most useful at sub-national levels: regional and sub-regional (district) level.
- An practitioner from Cordaid, working in South Sudan, underscored that the accuracy level can be a matter of concern when working with smallholder farmers, whose land can be very small. For instance, an accuracy of 12 meter may not be enough.
- In response to a question on the type of indicators that will be used for conflict prediction, a member of the C&M consortium explained that fine grained predictions require better resolution data, but that this is typically the bottleneck; there are constraints in terms of what kind of data will be available for these calculations, as monitoring every aspect in every part of a country is quite unrealistic. The model will thus have to find a balance. Examples of indicators that will be used include conflict history, antagonisms between communities, alongside other social, demographic, economic, governance and community indicators - combined with satellite imagery like town growth and land use.

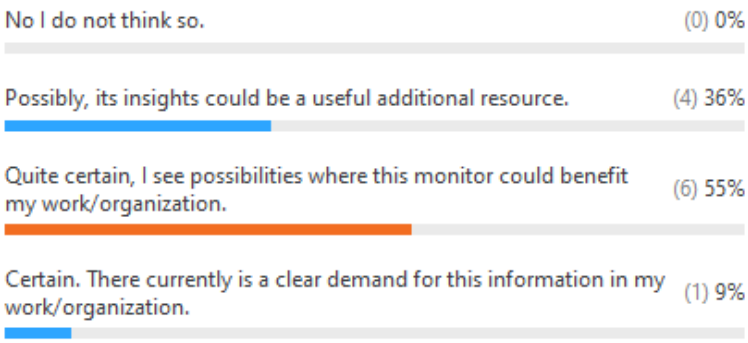
How to best organize the crowdsourcing aspects of the monitor? Any lessons from participants?

- To continue accessing data under COVID-19 restrictions, organizations have had to adapt their data collection systems. A practitioner from ZOA shared an example of their work in Liberia, where they adapted to a remote market monitoring system with weekly phone calls instead of field visits.
- A researcher shares that this now definitely takes more effort. They invested in ‘remote’ focus groups, by providing local stakeholders with connectivity (Internet access) and explaining how they could connect e.g. through Zoom. To include those people without online connectivity in the focus group discussions, local colleagues went to sit with the farmers, laborers and cooperatives.
- Another practitioner is interested to hear more about what indicators will be used to calculate the probability of conflicts. E.g. Does this mean looking at where conflicts or protests actually happen or also looking at more ‘subtle’ drivers such as tensions between communities or the rising economic inequality caused by COVID-19?
- C&M team members explain that a range of indicators are included and that essentially both geodata and crowdsourced data are needed to predict conflict. E.g. indicators for climate change (dry areas), different land use (e.g. large plantations), changing sizes of villages and cities (migration) and other changes in the larger region are included, but data on conflict history is also needed to predict conflict in the future. To then calculate conflict probabilities a number of indicators can be used (e.g. tensions between and within communities and many other social, demographic and economic indicators) that contribute to the predictability of conflict.

How to link up to what is already going on in the context (eg govt or other monitoring systems/frameworks)?

- Several practitioners underscored that while there are a lot of initiatives by different organizations for (remote) data collection, sharing of information remains a challenge. How can information sharing be improved between the different initiatives by (I)NGOs at work in a specific area as well as information collected at a higher level?
- As organizations collect, report and present data through different monitoring systems, information remains scattered. Standardization of the kind of data that is being collected by different systems, as well as these systems themselves, are points for attention in order to combine information.

Closing poll: This monitor can strengthen the work that I do/my organization does



Participant list

Name	Organization
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