# Tracking Traders: Using Smartphones to Map Food Systems

**Challenge.** Product value chains across the globe have become increasingly complex and food systems are no exception. When these systems fail, by allowing in contaminated or degraded agricultural products, it can be difficult to identify the entry point. Without better tools for identify the source of the breakdown, food value chains will remain vulnerable, endangering the health and livelihood of millions. What is needed are innovative methods that can provide policymakers with real-time information, allowing them to ensure resilient food systems.

Evolving complexities often go hand-in-hand with informality, making the mapping and monitoring of food systems difficult. Especially difficult in mapping any value chain is revealing the missing middle - those intermediaries that transport and trade products from producers to end-users. Identifying and tracking intermediary traders is thus key to better understanding the flows of agricultural products. We propose to use **GPS-equipped smartphones and SMS text messaging to track and survey intermediate traders in food systems.** This innovative method will allow us to generate real-time data on the movement and dealings of intermediary traders. In using these data, we will be able to accurately track time spent at different locations (i.e. farmgate, borders, wholesalers) and activities (i.e. searching for farmers, negotiating with sellers/buyers, quality inspections). We will be able to map flows of goods and identify new markets using GPS-equipped smartphones. Through SMS messaging we will conduct small economic surveys including questions about time-use, quantities bought/sold, and prices.

**Idea.** We propose to pilot our idea among intermediary traders in the potato value chain in Southeast Asia. The CIP-developed variety C88 is a high yielding and blight resistant cultivar introduced in Southern China. C88 seed potatoes have since made their way, through formal and informal channels, across the border into Vietnam. Local sources estimate that 70 percent of all potatoes grown in Vietnam's Red River Delta originated in China. Thus, we know the source and end-point of the potato trade, what remains unknown are the numerous trajectories that seed potatoes take in between. Because much of the cross-border trade is informal, there is a high degree of uncertainty regarding the genuineness of the C88 seed bought and planted in Vietnam. Since potatoes are vegetatively propagated, diseases accumulate over time, reducing farmer yields and threatening consumer health. We will equip traders in both countries with GPS-equipped smartphones that will allow us to identify where and when they engage in trade. Additionally, we will "ping" traders with short SMS surveys on time-use and market activity. Together, these will provide us with a real-time, dynamic dataset on an important food system in Vietnam.

**Novelty.** Our approach to mapping food systems is novel in several ways. First, our idea allows us to cost-effectively map agricultural flows in informal markets and trade at larger international scales. Food systems are dynamic and the use of GPS-equipped smartphones and SMS messaging allow us to capture real time data to visualize food system flows. This is a significant advance on traditional methods of data collection, which rely on enumerator visits weeks or months after the fact. Second, our innovation captures Big Data through the high-volume gathering real-time data from traders. Using Android-based GPS tracker apps we can trace intermediary trader activity at up to five second intervals, creating a near continuous stream of data. Third, we will be able to use the GPS tracks to cross validate the data collected via the SMS time-use surveys. This provides a methodological innovation on current methods of time-

use data collection. By randomly varying the frequency of the SMS surveys, we can compare the accuracy of standard data collection practices to the accuracy achieved from higher frequency surveys.

**Team.** <u>Dr. Gatto</u> (CIP) is an agricultural economist based in Hanoi. He has on-the-ground experience in designing and managing projects in Southeast Asia. In addition to the general management of the project, he will oversee implementation of data collection. Due to his proximity to the study region, he will be able to quickly respond to issues as they arise. <u>Dr. Michler</u>'s (Univ. of Saskatchewan) research utilizes innovative technologies to measure behavioral change. He has experience in designing and implementing field experiments in Africa and Asia. Given his experience and the resources available through the Social Science Research Laboratories at Univ. of Saskatchewan, he will provide technical expertise and backstopping regarding ICTs. Local knowledge and support is crucial to identify traders and for logistical support. In China, this will be provided by Prof. Canhui Li of Yunnan Normal Univ. In Vietnam, Dr. Chien, former Director of Root Crops Research and Development Center, will provide support.

**Time.** The first phase of the study will consist of preliminary work, including designing the survey, purchasing the devices, and testing GPS and text messaging capabilities. We intend to identify traders, inform them of the data collection process, and implement the survey on a rolling basis. This will be carried out jointly with consultants and enumerators in the border regions between China and Vietnam. Once the real-time data collection has been set-up, the final phase of the project will be spent on data curation, analysis, mapping, and on writing up reports for scientific publications.

| Activity | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Survey design | ■ | ■ | | | | | | | | | | |
| Identifying traders | ■ | ■ | ■ | | | | | | | | | |
| Survey launch | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Analysis & reports | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

**Funds.** Funds will cover staff time at CIP, Univ. of Saskatchewan, and our local collaborators. Drs. Gatto and Michler will both travel to China and within Vietnam to identify traders, test GPS on smartphones and text messaging. At the same time, local enumerators will be trained to identify and instruct traders. The main research costs are for unlocked smartphones and GPS-tracking apps. Additional costs are for text messaging, data bundles for internet, and trader participation rewards. Enumerator costs including their travel expenses are also included. We also budget for a GIS expert to help visualizing and interpreting data.

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| Staff | CIP | 14,000 |
| | Univ. of Sask. | 5,500 |
| | Consultancy | 9,800 |
| Travel | | 12,150 |
| Research | | 39,260 |
| Indirect Costs | | 18,626 |
| | Total | 99,336 |

**Next steps.** If our pilot is successful, we would like to see our innovation scaled up and out. Additional traders and countries can be added to get a more comprehensive picture of the potato trade in Southeast Asia. Also, other agricultural commodities, such as cassava or bananas, can be included. We believe that tracking intermediaries in value chains will be of interest to the private sector. Bringing together researchers, government, and agricultural business, to map, analyze, and better understand food systems is our goal.