IFPRI CRADA Discussion

Notes updated June 4, 2018 by Paul Mort and Jeremy Lechman

The following is a summary of an email thread that came out of a preliminary conference call and subsequent email discussions aimed at exploring possibilities for IFPRI to engage in a CRADA (Cooperative Research and Development Agreement). In addition, some background information on CRADA's is provided, along with some thoughts on how an IFPRI CRADA might be structured. The details of an initial CRADA proposal is based on the email thread. In no way should this be taken as an exclusive focus for IFPRI; rather, it is intended as a substantive example of what may be a reasonable first step.

While typical CRADA's have been formed between private companies or universities and a US National Lab, Institute, Department and/or Agency, the US legislation enabling CRADA's provides for agreements with "industrial organizations (including corporations, schools and partnerships, and limited partnerships, and industrial development organizations); public and private foundations; nonprofit organizations (including universities)." [1] Further, the legislation specifically gives "special consideration to small business firms, and consortia involving small business firms."

Establishing a CRADA between an agency and IFPRI (a collection of companies and associated academics) would be a new instance of a consortium approach. While this seems consistent with the legislation, IFPRI may need to address specific aspects pertaining to confidential information and intellectual property as a non-profit international consortium as opposed to a private company or university.

Following is a non-exhaustive list of possible models for IFPRI CRADA's:

1. As a supplement to a standard project or group of projects, IFPRI provides Collaboration Grants to one or more PI's, enabling their engagement with a National Lab/Agency. For its part, the National Lab/Agency contributes research equity to the IFPRI CRADA and shares in the PI's research output. There is no direct cash funding from IFPRI to the National Lab/Agency. Essentially, this option enables an individual or group of IFPRI PI's to go deeper and to gain the benefit of collaboration with National Lab resources.
2. A resource "jump-start" for a future project of common interest to IFPRI and a National Lab/ Agency. In this case, IFPRI provides a Collaboration Grant to one or more prospective PI's to engage in an exploratory IFPRI CRADA with the National Lab/Agency, with the objective of identifying a detailed study plan enabled by National Lab/Agency resources. A further step for IFPRI could be to fund the study plan as a standard project (e.g., convert to model #1). This is a way to accelerate a project.
3. Combining an IFPRI project with the Sandia National Laboratory Directed Research & Development (LDRD) program. This brings additional funding and resources from Sandia; combined with IFPRI, the scope of the project can be substantial. Academic Alliance LDRD's are limited to the current set of Academic Alliance Universities (New Mexico, Illinois, Purdue, Texas, Georgia Tech).
4. Multi-party CRADA's aimed at a substantial technical challenge (e.g., a Grand Challenge) requiring substantially greater resources:
    a. A sub-set of interested IFPRI companies pool supplemental company resources toward a specific CRADA topic, with additional matching funds from the National Lab/Agency.
    b. IFPRI joins with other entities (e.g., external companies, foundations, working parties, etc.), each entity providing funds to a study a specific CRADA topic, with additional matching funds from the National Lab/Agency.

[1] Link to the CRADA legislation: http://history.nih.gov/research/downloads/PL99-502.pdf

Following is a non-exhaustive list of potential IFPRI CRADA examples:

- Thinking back on previous examples of strategic partnerships in IFPRI, one could imagine a CRADA in support of the suspension rheology projects done by Wagner & Brady or Furst & Sollomon, including experimental (e.g., neutron scattering to probe suspension structure), analysis of experimental data, and computational modeling/simulation perspectives.
- Considering the current IFPRI program:
  - In the Dry Flow area, a CRADA could extend program scope to consider flow and stress field *fluctuations* in rheology models and measurements, e.g., Daniel's non-local rheology, McCarthy's segregation, Wu's die filling, Hare's powder flow characterization under low consolidation, and the proposed new project on boundary layer flows (consider current Higgs and Taberlet proposals).
  - In the Systems area, a CRADA could be used to jump-start an effort on process/structure/function relations. The quality and performance of products comprising particulates depends on distributed characteristics and structural attributes; the processes that are designed to transform raw materials must meet these attribute specifications. One can frame this as an overall system of models that describe critical relationships in the chain of raw materials, processes, particulate/product structure, product function and performance.
  - Other CRADA's can be proposed, either in association with an existing IFPRI project, or as part of a new project proposal.

Combining CRADA models with current or proposed IFPRI projects, potential topics could include:

1) Collaborating with the current non-local rheology project (Karen Daniels), development particulate rheology models accounting for effects of fluctuations in flow and stress fields, in both bulk and boundary layer conditions, e.g., using a statistical physics approach.
2) Collaborating with proposed boundary-layer flow project (Higgs or Taberlet), characterize boundary-layer fluctuations of critical interest for a range of forming processes and types of materials. Focus areas could include particulate materials processing science for high-consequence, small-lot precision manufacturing (e.g., Additive Mfg.), including process-structure-property relations and their relationship to variability in heterogeneous particulate materials (e.g., energetic or energy-storage materials).
3) A current LDRD proposal under consideration is focused on computer-aided design and optimization of compaction/tableting processes. Elements include enabling deformable particles (including yield/fracture/fragmentation) within DEM computational approaches as well as exploring the possibility of solving the inverse problem to optimize a desired property of the compact. This project would be a candidate for an Academic Alliance LDRD.
4) A "jump-start" for IFPRI's Systems Engineering focus area, exploring tools for process-structure-performance integration, especially in ways that facilitate inverse solutions (i.e., specifying structure and process models based on performance requirements).
   a. Do we have sufficient models to solve the inverse problems, i.e., for a desired product performance, what must be true of product structure, processing thereof, and materials used in that process? Are solutions amenable to optimization, even multi-objective optimization?
   b. Another goal can be to describe, e.g., via expert systems, details of the many-to-many relations between blocks in figure below, for example, detailed mapping of the relations between processes, materials and achievable structures or specifications.