Purpose of Portfolio Reviews

To distill, synthesize & analyze information across a collection of investments

> **Strategy**: inform new goals or assess alignment with current strategy
> **Measurement, Evaluation & Learning**: test causal pathways and theories of change, explain success and failure
> **Organizational**: identify synergies and gaps across teams or portfolios, map information flows
  – *(primarily internal to the organization – sharing horizontally)*
> **Communication and Accountability**: share activities and progress across teams, describe collective impact
  – *(internal, sharing vertically, and external)*
Strategy I

Inform new strategy or “refresh” existing strategy

> Answers: What are we doing?
  
  – Code and summarize investment characteristics by amounts, recipients, type of organization, target beneficiaries, geographies, methods, indicators, outcomes, etc.
  
  – “Data” provide summaries and surface patterns across grants

(2011) AgDev strategy refresh questions/requests
  
  – Categorize the 2006-2010 portfolio by OECD DAC Purpose Code
  
  – Map which investments address one or more market imperfections: public goods, externalities, market power and information problems
  
  – What public goods are we investing in? At what scale (local, regional, global)?

Largely descriptive
Strategy II

Assess investment alignment with strategy & theories of change

> **Answers: How are we doing what we are doing, and why?**
  > Describe collective outputs, outcomes and impact across grants & alignment with strategy

*(2013) Do our investments incorporate a gender perspective?*

> **Answers: What is our comparative funding advantage?**

*(2015) Describe the breadth and depth of Knowledge Exchange and Extension activities and how private sector-driven extension has been supported by BMGF investments. *(by sector)*

*(2012) How do our investments foster innovation? *(by activity)*
e.g. Innovation Impact Pathways

Researching, Developing, and Piloting New Global Public Goods

New Agricultural Products
- Upstream R&D
- New crop varietal development
- Diagnostic/surveillance tools
- Irrigation technologies
- Post-harvest tools and technologies
- Livestock technologies
- Value addition technologies

New Global Public Good Models
- Policy and advocacy
- Extension services
- Improved soil and water management tools
- Improved post-harvest and crop management/pest control technologies
- Structured demand and markets
- Information services
- Production models

Disseminating Innovation: Scaling, Adapting, and Enabling

Scaling and Adaptation
- Adapting agricultural products for new or local conditions
- Adapting global public good models for new or local conditions
- Scaling the delivery of agricultural products
- Scaling global public good models

Enabling Environment
- Prospecting and capacity building for innovation in local, national, or regional institutions
- Increasing capacity for local research
- Building capacity for NARS
- Training locals and/or students

Measurement, Learning and Feedback for Innovation

Data Collection and Availability
- Collecting data
- Building public information databanks

Diagnostics, Analysis, and Learning
- Analyzing and synthesizing information

Gender Focus | Digital Revolution in Agriculture

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Measurement, Learning & Evaluation

Largely analytic (requires a theoretical frame)

> **Answers: What do we track?**
  - Analyze grantee and funder capacity to measure and evaluate performance across investments through shared outcomes and common metrics

> **Answers: What can we learn?**
  - Assess the ability to learn from success and failure via underlying theories of change: are theories explicit and are data collected to test the assumptions underlying hypothesized causal pathways

(2014) Assess how grants measure the outputs, outcomes, and assumptions that inform the theory of change related to KEE activities.
## Answers what do we track: Activities and Outcomes

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<td>Prevalence of deficiencies in vitamin A, zinc, and vitamin C</td>
<td>Developing new crop varieties - Strengthening delivery mechanisms - Supporting</td>
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<td>Unfortified staple crops, targeting iron, zinc, and pro-vitamin A - Develops country</td>
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<td>Nutrients (starch and lipid)</td>
<td>Developing new crop varieties - Data collection</td>
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<td>Bean, soybean, and corn breeding studies (Report 3.1)</td>
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<td>World Cocoa Foundation</td>
<td>Farm diversification</td>
<td>Nutrition/health extension</td>
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<td>Lessons on varying nutritional needs of 1</td>
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<tr>
<td>International Rice Research Institute</td>
<td>Vitamin A, vitamin B-12, and vitamin C dietary measures included in proposal</td>
<td>Developing new institutional partnerships - Developing new crop varieties</td>
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<td>6</td>
<td>Develop safe, nutritious, biofortified rice - many different agricultural sectors</td>
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<td>International Bank for Reconstruction and Development</td>
<td>indices discussed in grant documentation</td>
<td>Data collection</td>
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<td>8</td>
<td>Collect panel surveys that include modules about health and nutrition and food consumption, expense</td>
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<td>Wageningen</td>
<td>Unmeasurable</td>
<td>Developing new</td>
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<td>Collect effort and efficiency of</td>
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Are Data Collected for Meeting Goals?

> Grants had an average of 8 times as many and up to 30 times as many activities and outputs as they did outcome indicators.
Answers: what can we learn?

AgDev ToC

Integrated client-driven interventions → Adoption → Sustainable productivity growth with emphasis on women → Poverty Reduction

Built on:
- Assumptions about farmer demand:
  Develop high yielding seeds
  Given access, people will adopt new technologies

Grant ToC

- Assumptions about biophysical relationships:
  Appropriate sustainable technology for agro-ecological zone

- Assumptions about market systems and households:
  Increased yield increases income and improves quality of life for all HH members
  Livelihoods improve

What if:
- adoption is higher/lower than expected?
- yield variability is greater than expected?
- yield improves but health or leisure of HH members declines?

We need:
- Input prices
  Seed price
  Price of crop
  Price of returns from alternate land use
  Risk
- Long term field trials under different environmental stresses.
  Changes in soil and water quality.
- Localized median of value of crops sold.
  Spousal control of resources.
  Time allocation of men, women and children.
Are Data Collected for Assumptions Testing?

(2014) Finding: The average grant collects data that could test 5 of the assumptions

- Increased productivity can be achieved in an environmentally sustainable manner.
- A crop-specific strategy can lead to sustained productivity growth.
- There are diversity and income pathways from agricultural development to improved nutritional outcomes.
- There is consumer/market demand for increased agricultural production.
- Increased productivity leads to poverty reduction.
- There is a demand for the technologies developed and products produced.
- Women farmers are unique, have a high leverage opportunity to increase productivity.
- Given access, incentives, and tools, farmers will adopt the technology/practice.
- A successful intervention can be scaled.
Organization I

Looking across teams with different strategies

> Answers: What are the common denominators foundation/organization-wide?
  - The more that strategies and investments diverge, the fewer common metrics
  - But for foundations with cross-cutting themes such as ML&E or gender, some collective commentary is still possible

(2010) What are the M&E expectations, methods, and resources across investments within Water, Sanitation, and Hygiene, Agricultural Development, Vaccine Delivery, Nutrition, Enteric and Diarrheal Diseases, HIV, Neglected and Other Infectious Diseases, Maternal, Newborn, and Child Health
Answers: are there gaps or synergies across portfolios?
Organization II

Map information sources, storage and accessibility

> Answers: How does the reporting and documentation structure, data accessibility and storage, and the sheer number of indicators allow the most important information to surface?

(2014) Provide an overview of monitoring and evaluation (M&E) systems used by the SGs, with a focus on 1) data flow and 2) data systems. Distinguish between data flows from the grantee to the Program Officer (grant level) and from the Program Officer through the foundation (foundation level). Data systems include the actual measurement, evaluation, and learning activities at the grantee level.
Answers: Do Consistent Reporting Formats Support Cross-Comparisons of Progress?

<table>
<thead>
<tr>
<th>#</th>
<th>Objective</th>
<th>Key Activities</th>
<th>Outcomes</th>
<th>Key</th>
<th>Action</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.1</td>
<td>Facilitate the implementation of improved regulation of fertilizers under existing and revised fertilizer laws and regulations in AGRA target countries</td>
<td>AGRA</td>
<td>National programs are better able to enforce fertilizer regulations using improved infrastructure and skills, leading to delivery of improved quality fertilizer</td>
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</table>
Assumed Pathway for Grantee Results Data

Grantee

Program Officer

Database

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Actual Flow of Information
Summary of Cross-Team & Strategy-Level Learning Challenges

- Managing M&E information for multiple uses
- Comparing and aggregating outcomes across grants
- Specifying the causal pathways and assumptions underlying a theory of change
EPAR’s Approach

> Combine human and machine review
  – Human review to define the project and develop project-specific frameworks (theory)
  – Machine review provides targets and guidance for human review

> Dual approach makes portfolio review cost-effective, scalable, and rapidly deployable
  – Can be used in adaptive decision-making
The Human Contributions

Define the Project
Identify project goals, questions, outcomes & desired analytics

Develop Project-Specific Framework
Use project goals and the academic and grey literature to identify the relevant quantitative and qualitative information to pull from each grant - the “data” entered and coded into a spreadsheet
- Investment characteristics:
  - geographic focus
  - strategic focus
  - budgets
- Theoretical framework:
  - hypothesized links between activities and outcomes
  - theory of change
- Outcomes & evaluations:
  - investment performance
  - outcome measurement
  - ability to test assumptions

Gather Program Documents
Supplement existing documents (Foundation grant proposals, annual reports, & more) with documents from public grantee websites

Review and Code Grants
Summarize grant information and coding rationales into "Notes Sheets" for future review and compile information into a central coding spreadsheet

Intermediate Reviews to Check for Coding Consistency
Review coding decisions to ensure uniform methodology

Final Reviews & Analysis
Review central coding spreadsheet and conduct Foundation requested analysis of data

Present the Results
EPAR final products include but are not limited to: literature reviews of theories of change and evidence in the area of interest, summative reports of the portfolio review, spreadsheets and pivot tables of the data coded from the grants, and slide decks
## Theoretical Framework

<table>
<thead>
<tr>
<th>Grants</th>
<th>Information collection and dissemination</th>
<th>Collaboration</th>
<th>Increased nutritional purchasing ability</th>
<th>Own production (includes biofortification)</th>
<th>Direct food provision</th>
<th>Participant health status &amp; knowledge</th>
<th>Gender Sensitive</th>
<th>Total Number of Pathways</th>
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<td>Living Standards Measurement Survey (LSMS)</td>
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<td>The Effects of Market Integration on the Nutritional Contributions of Traditional Foods to the Wellbeing of the Rural Poor in Africa</td>
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<td>N2Africa: Putting Nitrogen Fixation to Work for Smallholder Farmers in Africa</td>
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<td>Assessment of Foundation Grants' Gender Responsiveness</td>
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<td>WFP Comprehensive Food Security and Vulnerability Analysis in 16 Sub-Saharan African Countries</td>
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<td>Reaching Agents of Change (RACs): Catalyzing African Advocacy and Development Efforts to Achieve Broad Impact with Orange-fleshed Sweetpotato (OFSP)</td>
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<td>CSISA: Cereal Systems Initiative for South Asia</td>
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<td>A Political Economy Analysis of the Global Food Crisis 2007-2009</td>
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<td>Development of Bananas with Optimized Bioavailable Micronutrients</td>
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*Machine assistance*
Assessing Word Frequencies Can Test Alignment with Strategy
Simple Word Searches Can Help Target Human Review

- Decision-Making words: decis, household, autonom, choic, power
- Control over Assets words: control, asset, resourc, access, own, ownership, power
- Norms words: norm, attitud, behavior, status, belief, believ, shame, cultur
- Self-Esteem words: esteem, confid, dignit, respect, efficac, resili
- Violence words: violenc, violent, abus, assault, rape, safe, trauma, harass
- Collective Action words: dialogu, club, network, group, engag, solidar
- Mobility words: move, access, space, market, free, freedom
- Leadership words: leadership, role, mentor, coach, inspir

[Graph showing word counts for different categories]
The Machine Contributions

The role of text analysis and machine learning tools:

Developing a set of open-source resources for supplementing and automating portfolio review processes using:

- Social scientific software (e.g. Python and R)
- Basic Text Mining Approaches via R
- Supervised learning, machine learning
  - Natural language processing
    - Entity and keyword extraction
    - Geotagging
    - Relation extraction
  - Topic Modeling
Two Approaches

> General Description
  – Describe, classify, categorize automatically
    > Provides time savings, replicability

> Exploration and Discovery
  – Model, explore, discover interactively
Description

- Categorize/classify documents
- Correlations across words/documents
- Frequencies within opportunities
- Targeted locations within documents

Paragraphs → Break into sentences, words

GeoTagging → Topic Model
Example 1: Automatic Geotagging

Where are agriculture and nutrition grants targeted?

> Rather than search for countries, with a trained geomodel, one can tag what documents discuss which countries

  – We apply the Cliff geocoding application to the documents to generate a map of “relevance”
Geographic Description

Manual versus automated coding

Agricultural Development – Nutrition Portfolio Overlap

Countries Corresponding to Selected Opportunity(ies)
Source: CLIFF

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Example 2: Predicting Document Categories

> Which documents within all agriculture and nutrition grants target agriculture or nutrition?

– Manual review identified 30 grants out of 257 grants.

– Automated review can speed up the process,
If we want grants related to “Agriculture,” “Nutrition,” or “Both,” then we can fit a topic model that provides keywords for topics that are extracted from data – Relevant grants identified via grant title in file name.
Manual Coding of “Agriculture/Nutrition”

> **Agriculture:** 5, 6, 9, 10, 13, 16, 19, 20, 21, 22, 23, 33, 34, 35, 36, 41, 42, 44, 47, 48, 50, 52, 55

> **Nutrition:** 37, 46

> **Post-Tagging:**
Document On Agriculture = Union of Topic Probabilities
Identifying Relevant Documents/Grants

> Probabilistic rather than discrete
  - Goal is to be mostly right

> Generally effective at matching manual coding
  - What “topics” are miscategorized?
  - What differences were identified in human versus manual coding?

Document/Opportunity Level

Paragraph Level
Method

Paragraphs

Sentences, words (only keep causal verbs)

Geotagging

Topic Model

Logic Model

NLP via AlchemyAPI

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Motivating a Program Theory Assessment

**What:** developing new crop varieties

**How:** What are the causal pathways?

**Outputs:** What do R+D activities produce?

**Outcomes:** Improved nutrition

**NOTE:** Tie between outputs and outcomes is often vague/unclear if there is no formal logic model
Pathways for Impact

What are the pathways by which developing new crop varieties (R&D activities improving seeds) improves smallholder productivity and/or nutrition?

1. Identify actions
   - Topic Model

2. Identify how/pathways
   - Extracting causal patterns that connect policy actions/interventions to outputs and finally outcomes

3. Identify outcomes
   - Can look for both outputs and outcomes
   - Identify potential indicators
Manually Coded Activities

> Developing new crop varieties (R&D to improve seeds)
> Strengthening delivery mechanisms (value chain focused activities linking farmers to new technologies)
> Agricultural extension (extension activities focusing on improved technologies or crop management)
> Nutrition/health extension (extension activities focusing on nutritional benefits of different crops)
> Other education (education ranging from finances to advocacy)
> Data collection (crop studies and surveys on agriculture/nutrition)
> Data analysis (analysis of studies and surveys, publications of findings)
> Developing informational resources (resources ranging from web portals to extension guides to journal articles)
> Supporting collective action (activities establishing local groups)
> Creating institutional partnerships (collaborative activities promoting partnerships between institutions)
Thinking About Theory

New crop varieties

Mechanism

Outcome

- Actions
- Causality
- Indicators

Topics 21, 19, 42, 34

Identify documents where $P(21 \cup 19 \cup 42 \cup 34)$ is maximized
1. Identify Actions

“Developing new crop varieties (R&D to improve seeds)”
2. Identify How / Pathways

- Causal verbs indicate pathway (theoretical)
- 1. Extract sentences with causal verbs
- 2. Map verbs to subjects, direct objects
- 3. Using list of “causal” sentences:
  - Classify all pathways within high probability of seed R+D Topics
    > Evaluate for patterns
  - Pick high probability words for topic, seek out pathways
Natural Language Processing

- Rely on Stanford NLP, OpenNLP, IBM AlchemyAPI
- Utilize structure of sentence to extract causal pathway
  - Working towards automated logic model identification
Linking Word Trees

Subject-verb-object trees for “vari” within chosen topics

- fast track varieties
- farmer preferred varieties
- varieties Data
- variations
- various indicators
- various training workshops
- variety
- improved varieties
- various institutions
- soil variability
- resistant varieties
- yielding legume varieties

be appropriate genetic backgrounds
be BSM marker
be IITA
be enhanced varieties
be Data
be use parameters
be include building activities
be associate livelihood programmes
be come teams Sall et
be TLI Phase
be Consortium Agreement
be GCP components
be trial
be affect legume production
be produce sufficient food
Extract Trees

> Purpose:
- Can motivate follow-up investigation
- Can help prioritize human coding efforts
- Can identify causal pathways rapidly
- Can show what grants might rely on similar pathways
### Extract Trees: Seeing Patterns

Subject-verb-object trees for "varieties" within chosen topics

<table>
<thead>
<tr>
<th>fast track varieties</th>
<th>bring</th>
<th>appropriate genetic backgrounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>farmer preferred varieties</td>
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<td>legume production</td>
</tr>
</tbody>
</table>
Extract Trees: Finding Pathways

Subject-verb-object trees for "research" within chosen topics

- research projects
- research program
- CGIAR research
- chickpea research
- Groundnut research
- agricultural research
- potential research partners
- national research communities
- research organizations
- CGIAR research
- Cowpea research
- research partners
- researchers
- bona fide researchers
- International Development Research
- ILRI Regional Research
- researchers
- development
- outcome mapping approach
- different strategies
- sub-grantee
- question
- assess
- snowball
- recognize
- different concepts
- strategies
- IP CRIS
- criteria
- projects
- indicators
- poverty reduction
- food security
- African partnership goals
- new markers
- suitable markets
- deep rooted
- MARC approaches
- efficiency
- disease resistance
- planning workshops
- modern breeding techniques
- efficiencies
- national breeding programs
- speed
- clarify
- meet
- have
- test
- identify
- confirm
- play
- be
- promote
- relate
- analyze
- allocate
- facilitate
- undertake
- develop
- manages
Extract Trees: Narrowing Scope

Filtering for “identify” and “research” within chosen topics

- research
- Groundnut research
- chickpea research

- gender gaps
- ownership
- strategies
- new markers
- pod borer
- suitable markers
- deep rooting
- MABC
- drought stress
- drought tolerance QTL
- Phase
- MABC approaches
Extract Trees: Exploring Connections

Searching for “seed”
Extract Trees: Identifying Key Concepts / Players

Why “Rockefeller Approach”?
3. Mapping Actions to Outcomes
3. Mapping Actions to Outcomes

- micronutrient density
- enhancing agronomic practices
- nutritional status
- making household decisions
- preschooler nutritional status
- various developing countries
- nutritional security changes
- include impact variables
- long term
3. Mapping Actions to Outcomes: Nutrition as Outcome

HKI is an expert in deploying nutrition interventions, while IRRI is skilled in developing nutritionally enhanced rice varieties.
Improved Seed and Nutrition?

Towards a logic model: Seed R+D can improve nutrition through partnerships between research organizations and engagement organizations.

Notice prevalence of organizational partners: improved seed can't lead to improved nutrition without working with smallholders, requires different expertise.
Then Iterate Back to Descriptive Searches Based on Pathways

- What target locations?
- Which grants?
- Which program officers?
- What concepts are related?
Evans School Policy Analysis & Research Group (EPAR)

Professor C. Leigh Anderson, Principal Investigator
Professor Travis Reynolds, co-Principal Investigator

EPAR uses an innovative student-faculty team model to provide rigorous, applied research and analysis to international development stakeholders. Established in 2008, the EPAR model has since been emulated by other UW schools and programs to further enrich the international development community and enhance student learning.

Please direct comments or questions about this research to Principal Investigators C. Leigh Anderson and Travis Reynolds at epar.evans.uw@gmail.com.