Sampling Guide for Beneficiary-based Surveys for Select Feed The Future Agricultural Annual Monitoring Indicators & Sample Size Calculator

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TOPS/FSN Network East & Southern Africa Regional Knowledge Sharing Meeting
Kampala, Uganda Sept 20-22, 2016

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

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FOOD AND NUTRITION TECHNICAL ASSISTANCE

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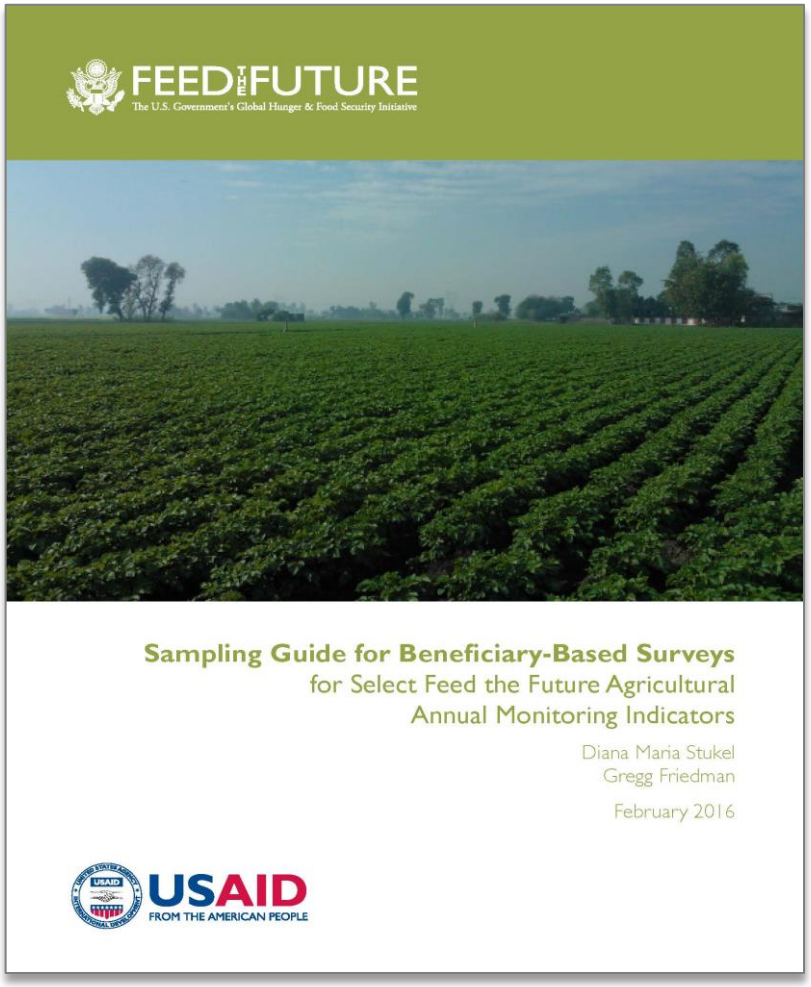
Introduction

Feed the Future (including Food for Peace (FFP)) Implementing Partners (IPs) must report annually to USAID on a set of Feed the Future annual monitoring indicators

Data collection options for annual monitoring

Introduction

FANTA Sampling Guide for Beneficiary-based Surveys and accompanying *FANTA Excel-based Sample Size Calculator*



Introduction

CHAPTERS IN THE FANTA SAMPLING GUIDE FOR BBSs

Chapter 1 - Purpose and background
Chapter 2 - Four selected Feed the Future annual monitoring indicators
Chapter 3 - Comparison of RM and BBSs
Chapter 4 - When are BBSs appropriate?
Chapter 5 - Timing and frequency of BBS data collection
Chapter 6 - Issues to consider when outsourcing work to an external contractor
Chapter 7 - Sampling frame guidance for BBSs
Chapter 8 - Overview of various approaches for collecting annual monitoring data using BBSs
Chapter 9 - The Household Survey Approach (Approach 1)
Chapter 10 - The Farmer Groups Approach (Approach 2)
Chapter 11 - Sample weighting
Chapter 12 - Producing estimates of indicators
Chapter 13 - Producing confidence intervals and standard errors associated with the indicators

Session Objectives

1. Learn under what circumstances BBSs are appropriate
2. Discuss a few approaches and sample design elements covered in the guide
3. Understand how to undertake a sample size calculation and observe a demonstration of the on-line Excel-based sample size calculator that accompanies the guide

Annual Monitoring Indicators

- Annual monitoring indicators reported to Feed the Future span various sectors: Agriculture, Maternal and Child Health and Nutrition (MCHN), Resilience and Gender.

- Different data collection mechanisms may be needed to support indicators from different sectors

- Most Feed the Future annual monitoring indicators are agriculture-based indicators, so guide focuses on data collection for these

- Feed the Future identified 4 agriculture-based annual monitoring indicators for which data collection is deemed particularly challenging

- All 4 indicators are either totals or functions of totals – so different considerations needed than for indicators of proportions or means

Four Challenging Agriculture-based Annual Monitoring Indicators

- Gross Margins
- Value of Incremental Sales
- Number of Farmers and Others who have Applied Improved Technologies or Management Practices as a results of USG assistance
- Number of Hectares of Land under Improved Technologies or Management Practices as a results of USG assistance

Other Feed the Future Agriculture-Based Annual Monitoring Indicators to Potentially Include in Agriculture-based BBSs

- Value of agricultural and rural loans
- # farmers who practiced value chain activities promoted by project
- # MSMEs including farmers receiving USG assistance to access loans
- # MSMEs including farmers receiving business development services from USG-assisted sources
- # MSMEs including farmers receiving assistance to access savings programs

Feed the Future Annual Monitoring Indicators to Collect through Other Means (e.g., routine monitoring, project records, different kind of BBS)

- # individuals who have received USG-supported agricultural sector productivity of food security training
- # people implementing risk-reducing practices/ actions to improve resilience to climate change as a result of USG assistance
- **#** private enterprises, producer organizations, water users associations, women's groups, trade & business associations, and CBOs that applied improved technologies/ management practices as a result of USG assistance
- # food security private enterprises, producer organizations, water users associations, women's groups, trade & business associations, and CBOs receiving USG assistance
- Total increase in installed storage capacity
- Kilometers of roads improved or constructed
- # market infrastructures rehabilitated and/or constructed
- # rural households benefitting directly from USG interventions
- Proportion of female participants in USG-assisted programs designed to increase access to productive economic resources
- All MCHN indicators (10)
- All resilience indicators (4)

BBS versus Routine Monitoring?

Routine Monitoring data collection:

- **IMPLEMENTED BY:** Project staff (M&E personnel or agriculture extension workers)
- **LINKED WITH PROJECT IMPLEMENTATION:** Data collection either concurrent with project implementation (e.g., during farmer field school) or at same time as regularly scheduled visits to farmer's plots coinciding with key points in production cycle
- **FREQUENCY OF COLLECTION:** On a continuous basis throughout the year
- **TARGET:** ALL direct beneficiaries

BBS versus Routine Monitoring?

BBS data collection:

- **IMPLEMENTED BY:** Third party firm typically (but can also be implemented by project staff in some cases)
- **GENERALLY NOT LINKED WITH PROJECT IMPLEMENTATION:** Data collection not linked if BBS uses household survey approach, but can be linked if surveying farmer groups
- **FREQUENCY OF COLLECTION:** One or more data collections during year
- **TARGET:** A sample of direct beneficiaries

Test Your Knowledge #1

What are the advantages of conducting a BBS over using Routine Monitoring (RM)? (Check all that apply)

- ❑ Number of beneficiaries on which data collected is smaller through BBSs than through RM
- ❑ BBSs allow for direct measurement on key data points through visit to farmers' plots
- ❑ BBSs do not require specialized skills in survey design and implementation
- ❑ Data from BBSs can be fed back to project staff more frequently than data from RM
- ❑ Data collection for BBSs can be integrated into project implementation (e.g., at same time as farmer group meetings)

Test Your Knowledge #1 (Answers)

What are the advantages of conducting a BBS over using Routine Monitoring (RM)? (Correct marked in green)

- ❑ Number of beneficiaries on which data collected is smaller through BBSs than through RM
- ❑ BBSs allow for direct measurement on key data points through visit to farmers' plots
- ❑ BBSs do not require specialized skills in survey design and implementation
- ❑ Data from BBSs can be fed back to project staff more frequently than data from RM
- ❑ Data collection for BBSs can be integrated into project implementation (e.g., at same time as farmer group meetings)

When is it appropriate to conduct a BBS?

Large project and inadequate number of data collection staff

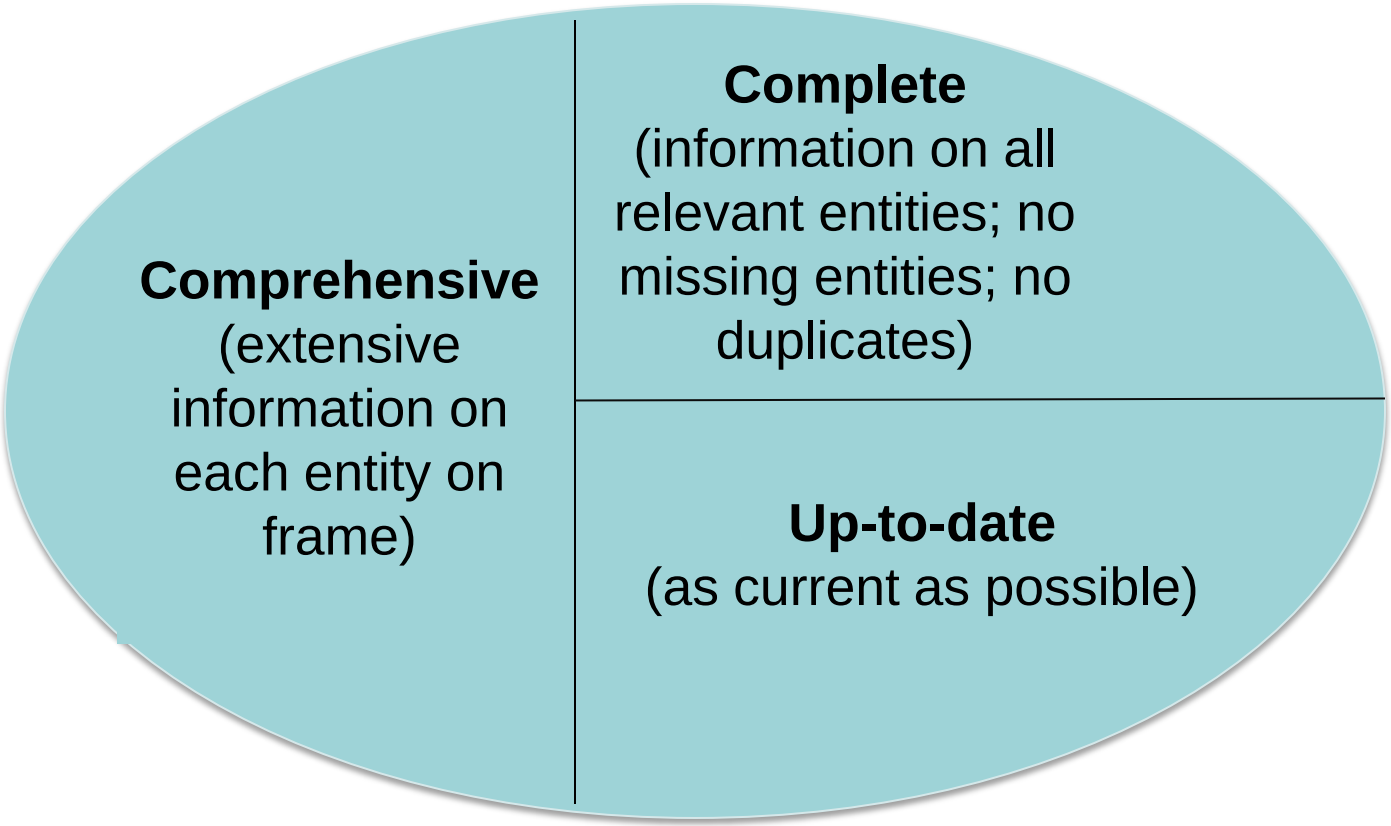
Farmer estimates of key agriculture-related data (such as plot size) considered unreliable and direct measurement through visit to farmer's plot preferred

Lack of direct contact between project and its beneficiary farmers

What is a Sampling Frame?

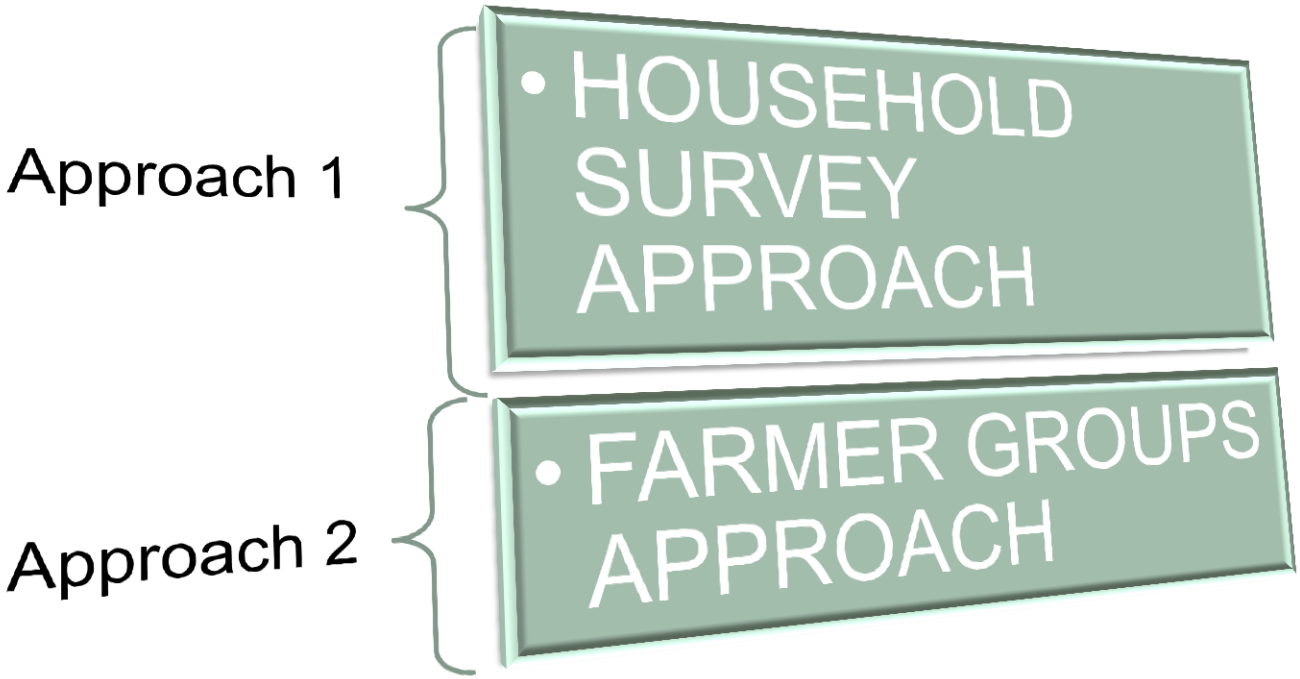
- Back-bone of BBSs!
- Comprises complete lists of units for various stages at which sampling takes place
- E.g. Two Stage Cluster Sampling Design
  - Frame 1: Complete list of clusters (e.g., villages or farmer groups) in project implementation area
  - Frame 2: Complete list of direct beneficiaries within each cluster
- E.g. One Stage Sampling Design
  - Frame 1: Complete list of direct beneficiaries within project implementation area

Characteristics of a High Quality Sampling Frame



Importance of high quality beneficiary registration system!!!

Two Suggested Approaches to BBSs



Two Suggested Approaches to BBSs

Approach 1: Household Survey Approach

- Resembles traditional household survey but on direct beneficiary population rather than entire population in project implementation area
- Various survey design options:
  - One-stage sampling of direct beneficiaries (used less often) OR
  - Two-stage sampling: first stage sampling of clusters (villages or communities) followed by second stage sampling of direct beneficiaries within sampled villages/ communities
- Households not directly sampled as in more traditional approaches but beneficiaries interviewed at their households or individual farmer plots
- **Lot Quality Assurance Sampling (LQAS) not recommended for collecting annual monitoring data**

Two Suggested Approaches to BBSs

Approach 2: Farmer Groups (FG) Approach

- Less traditional approach where interviewing conducted during project implementation (e.g., at a meeting of a FG during farmer field school)
- One survey design option (Two-stage sampling):
  - First stage sampling of FGs (not households!)
  - Second stage selection of ALL (not subset of!) direct beneficiary farmers within sampled FGs
- Farmers interviewed at next meeting of FG

Two Suggested Approaches to BBSs

Approach 2: Farmer Groups Approach

Appropriate:

- For projects with large number of beneficiaries and inadequate number of data collection staff

AND

- When direct measurement on key indicators (such as plot size) NOT deemed necessary

AND

- When project works with farmer groups

Two Suggested Approaches to BBSs

Approach 2: Farmer Groups (FG) Approach

- Data relating to 4 agriculture indicators are collected with reliance on farmer recall
- No direct measurement of data (e.g., plot size) possible since no visit to farmer plot
- Data are sample weighted to represent all project beneficiaries receiving agriculture goods, services or training
- Less time & resource intensive than Approach 1, (no need to locate, visit and take measurements at households) but may yield less accurate results

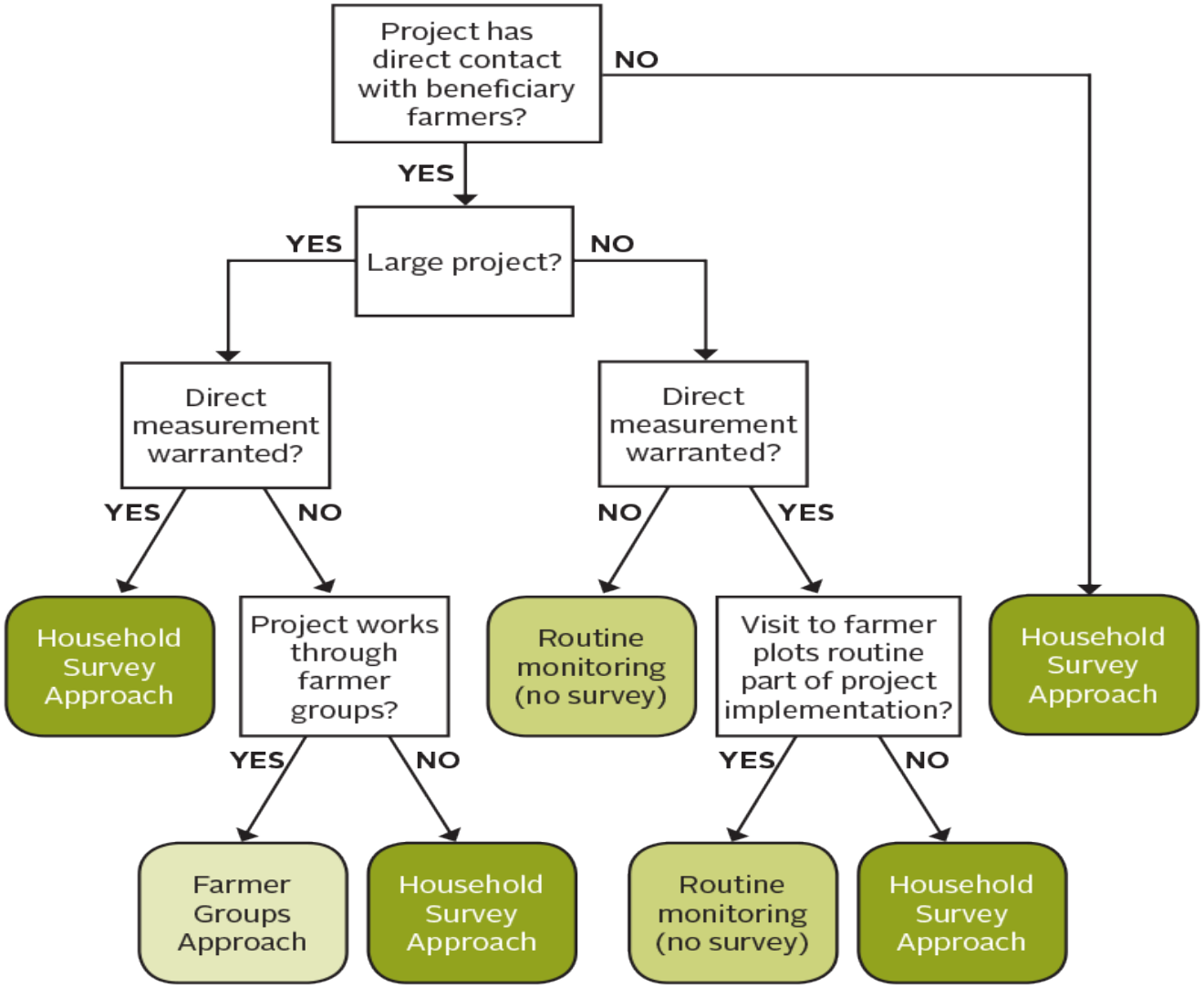
Two Suggested Approaches to BBSs

Approach 2: Farmer Groups (FG) Approach

Challenges in implementing this approach:

- Importance of maintaining frame of FGs and frame of beneficiaries within each FG
- Importance of interviewing farmers individually to avoid biased results and to uphold confidentiality protection
- Practical issues with interviewing all 15-30 farmers in a sampled FG during one session; need for dedicated meeting and sufficient number of interviewers
- Unpredictable sample size since approach reliant on farmers attending next meeting of FG

How to Choose the Right Approach?



Test Your Knowledge #2

Case Study Example: You are implementing a **small project** where you work **directly with beneficiary farmers** on a number of agriculture-based interventions. Experience in other surveys indicates that farmers provide **inaccurate estimates of their plot sizes**. Project interventions currently **do not include periodic visits to farmers' plots** by M&E staff or agriculture extension workers. Using the flow diagram, what would be the best means of collecting annual monitoring data? (Check one only)

- ❑ BBS using Household Survey Approach
- ❑ BBS using Farmer Groups Approach
- ❑ Routine Monitoring (no survey)

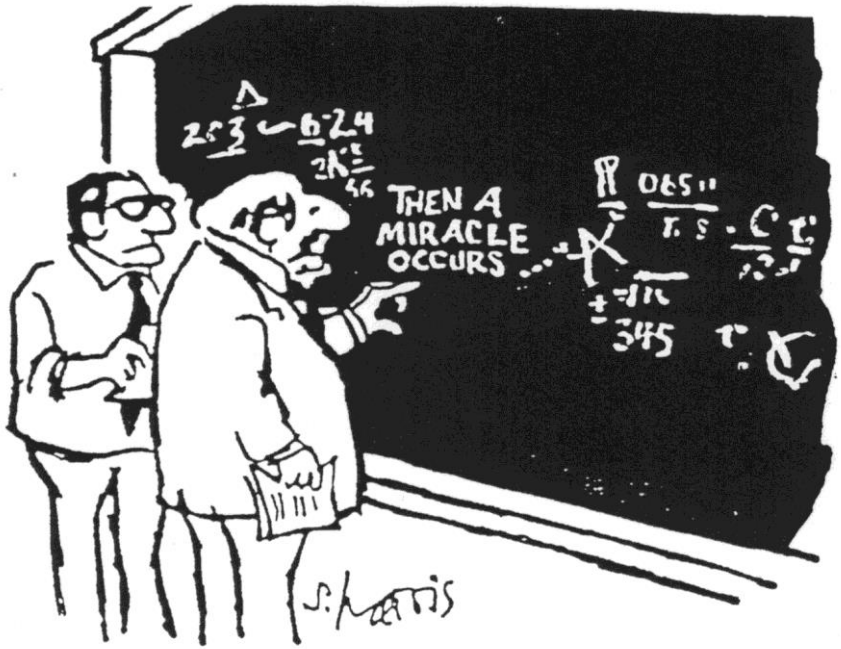
Test Your Knowledge #2 (Answers)

Case Study Example: You are implementing a **small project** where you work **directly with beneficiary farmers** on a number of agriculture-based interventions. Experience in other surveys indicates that farmers provide **inaccurate estimates of their plot sizes**. Project interventions currently **do not include periodic visits to farmers' plots** by M&E staff or agriculture extension workers. Using the flow diagram, what would be the best means of collecting annual monitoring data? (Check one only)

- ☑ BBS using Household Survey Approach
- ☐ BBS using Farmer Groups Approach
- ☐ Routine Monitoring (no survey)

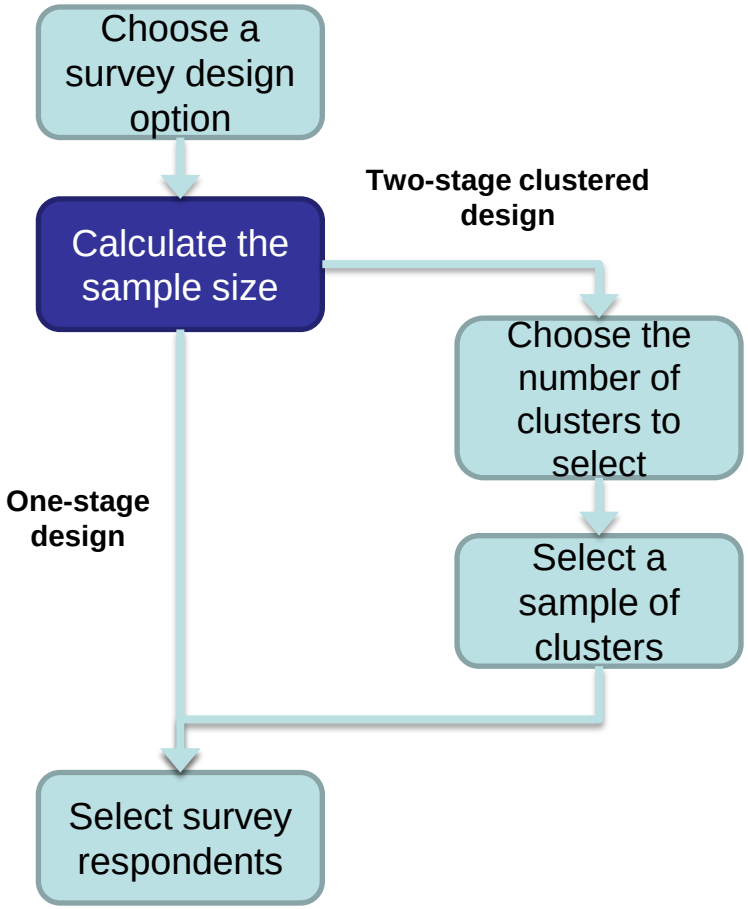
Survey Steps for Approaches 1 & 2

Both the Household Survey Approach and the Farmer Groups Approach entail a number of survey design steps…..

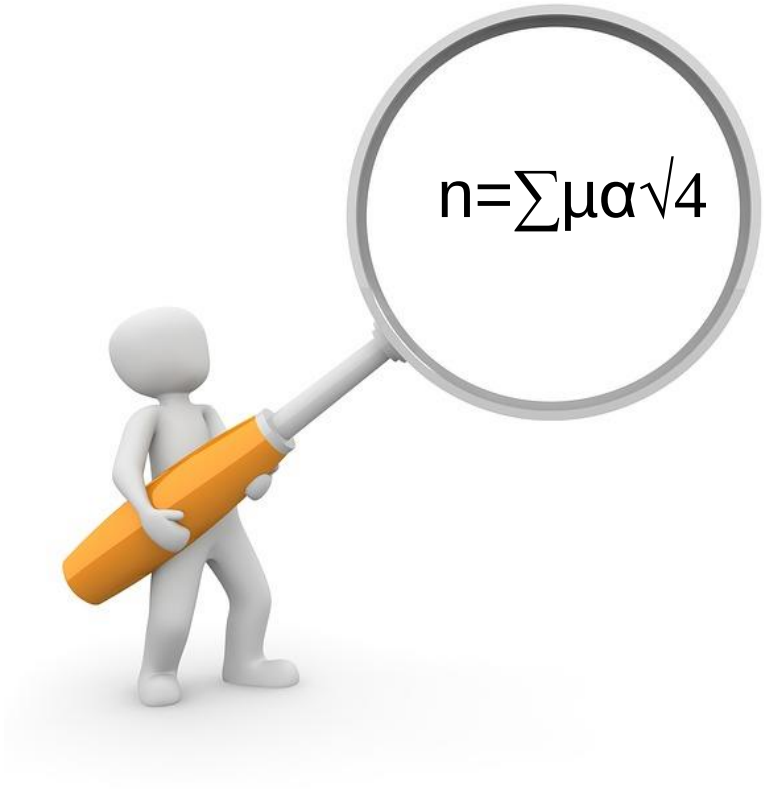


I think you should be a little more specific, here in Step 2

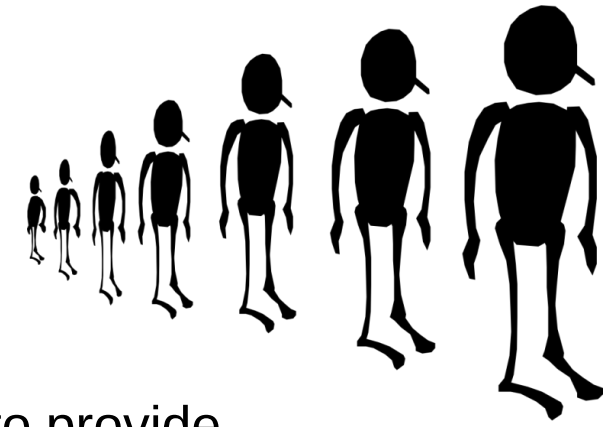
Survey Design Steps for Drawing a Sample Using Approaches 1 & 2



Survey Step:
Calculate the Sample Size



Calculate the Sample Size



- BBSs are “descriptive surveys” where the interest is in producing estimates of indicators to provide snapshot of situation at a single point in time
  - Aim is to achieve estimates with high “precision” (i.e., low standard errors) by controlling the sample size
  - Specific sample size formula needed for “single point in time” estimates
- Most Feed the Future agricultural annual monitoring indicators are totals or functions of totals
- **Use specific sample size formula for “single point in time” estimates that are totals**

Test Your Knowledge #3

We do not use sample size formulas to support statistical tests of differences over time for indicators of totals. Why? (Check one only)

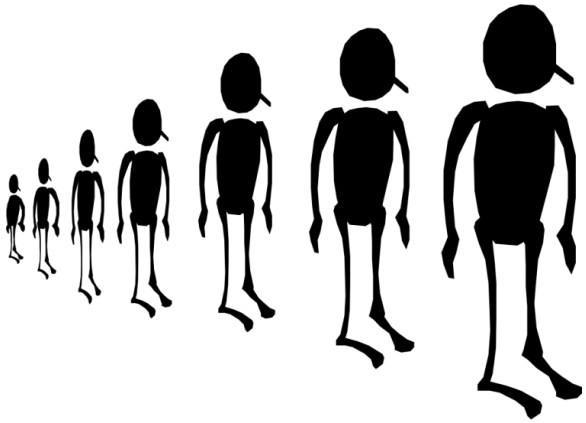
- ❑ A) Testing for statistical differences of indicators of totals does not make sense
- ❑ B) Testing differences of totals is not the main aim in the context of annual monitoring

Test Your Knowledge #3 (Answers)

We do not use sample size formulas to support statistical tests of differences over time for indicators of totals. Why? (Check one only)

- ☑ A) Testing for statistical differences of indicators of totals does not make sense
- ☐ B) Testing differences of totals is not the main aim in the context of annual monitoring

Calculate the Sample Size:
Four Challenging Agriculture based Annual Monitoring Indicators



- Gross Margins (function of totals)
  - Sample size formula complex, so not recommended to use Gross Margins for sample size computation
- Value of Incremental Sales (total – constant)
- Number of Farmers and Others who have Applied Improved Technologies (total)
- Number of Hectares of Land under Improved Technologies (total)

Calculate the Sample Size

Example: Value of Incremental Sales

$$VIS = VS_{RY} - [\left(\frac{N_{RY}}{N_{BY}}\right) VS_{BY}]$$

where

- VS_{RY} = *Value of sales for reporting year (value obtained from current BBS)*
- VS_{BY} = *Value of sales for base year (value is known from base year data collection)*
- N_{RY} = *Number of beneficiaries for reporting year (value is known from project records)*
- N_{BY} = *Number of beneficiaries for base year (value is known from base year project records)*

- At time of BBS, all above values known constants except VS_{RY}
- *VIS* is essential a total minus a constant, i.e., a total

Calculate the Sample Size

Sample size formula for a single point-in-time estimator of a total:

$$initial\ sample\ size = n_{initial} = \frac{N^2 * z^2 * s^2}{MOE^2}$$

where

- *N* = total number of beneficiary farmers
- *z*= critical value of normal distribution (typically use *z*= 1.96)
- *s*= standard deviation of the distribution of beneficiary data
  - If no prior value available for *s*, use estimate:

$$s = \frac{maximum\ value\ of\ indicator\ for\ individual\ beneficiary\ - minimum\ value\ of\ indicator\ for\ individual\ beneficiary}{6}$$

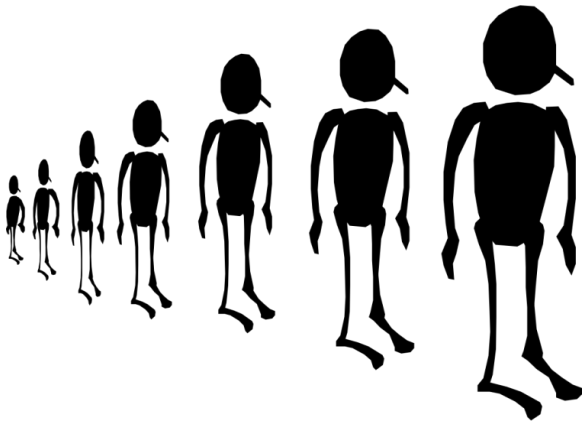
- *MOE* = margin of error = *p* target value of indicator*
  - *p*=acceptable percentage error; typically 0.05≤*p*≤0.1
  - *p*=0.1 recommended for annual monitoring

Case Study Example

You are the M&E specialist for a Feed the Future project in Burundi. You have decided to conduct a beneficiary-based survey (BBS) to collect your agricultural annual monitoring data and you need to calculate the sample size for the survey. You have decided to use a household survey approach using a two-stage clustered design. One of the indicators of interest is the Value of Incremental Sales. Here is some information on your project:

- Number of beneficiaries: 60,000 small-holder farmers
- Expected maximum value of sales for any individual beneficiary: US$1,200
- Target value of sales over all beneficiaries for this year: US$15,000,000 (or US$250 per beneficiary)

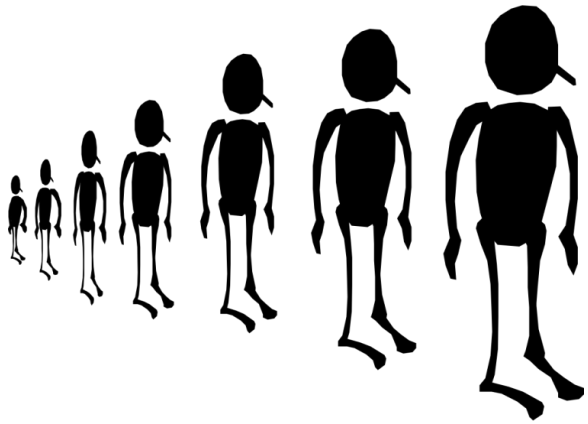
Calculate the Sample Size



Example: Value of Incremental Sales

- ***N***=60,000 small-holder beneficiary farmers
- ***z***= 1.96
- ***s***: no prior value available so must use estimate
  - Maximum value of sales for individual beneficiary is US$1,200
  - Minimum value of sales for individual beneficiary is US$0
  - *s* = (US$1,200 – US$0)/ 6 = US$200

Calculate the Sample Size



Example: Value of Incremental Sales (continued)

- ***MOE*** = margin of error = *p* target value of indicator*
  - *p*=0.1 (recommended value for acceptable percentage error)
  - Target value of indicator is US$250 for each individual beneficiary, or US$15,000,000 for N=60,000 farmers
  - MOE = 0.1*US$15,000,000 = US$1,500,000
- $\boldsymbol{initial\ sample\ size} = n_{initial} = \frac{N^2 * z^2 * s^2}{MOE^2} = \frac{60{,}000^2 * 1.96^2 * 200^2}{1{,}500{,}000^2} =$ **246**

Screen shot from accompanying sample size calculator

SAMPLE SIZE CALCULATOR FOR BENEFICIARY-BASED SURVEYS IN SUPPORT OF SELECT FEED THE FUTURE AGRICULTURAL ANNUAL MONITORING INDICATORS

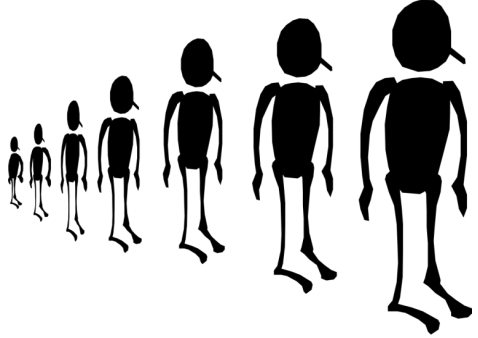
Please fill in appropriate values or select choices from the drop-down boxes provided for all cells highlighted in red.

SURVEY DESIGN OPTION		1 - Two-stage cluster design with systematic selection of beneficiaries	
INDICATOR		2 - Value of incremental sales (collected at farm level) attributed to USG implementation	
INITIAL SAMPLE SIZE	**N**	**Population of beneficiaries**	**60,000**
		Estimate of standard deviation available?	**NO**
		If YES, write estimate here (in units of indicator):	

If NO, provide estimates of minimum and maximum:

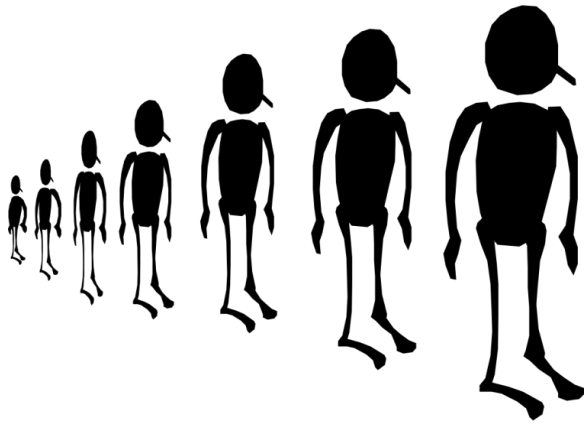
max	Estimate of maximum (per beneficiary)	1,200.00
		units of currency
min	Estimate of minimum (per beneficiary)	0.00
		units of currency
s	Standard deviation	200.00
p	Acceptable percentage error (Margin of error parameter)	10.0%
	Target value of indicator (Margin of error parameter)	15,000,000.00
MOE	Margin of error	1,500,000
	Confidence level	95%
z	Critical value from Normal Probability Distribution	1.96
$n_{initial}$	Initial sample size	246

Calculate the Sample Size



- Three adjustments to the initial sample size needed
- $final\ sample\ size = n_{final} = n_{initial} * adj_{FPC} * adj_{DEFF} * adj_{NR}$
- adj_{FPC} = Finite Population Correction adjustment
  - Need for populations that are small relative to initial sample size (i.e., when $n_{initial} > 0.05 * N$)
  - Can reduce sample size somewhat in this case
  - Most often not needed and if not adj_{FPC} **=1**
- adj_{DEFF} = Design Effect (DEFF) adjustment
  - Need for two-stage cluster designs
  - Need to increase sample size to compensate for intra-cluster correlations
  - Use value of DEFF for same or similar indicators from prior surveys
  - In absence of prior information, use adj_{DEFF} **=2**
- adj_{NR}= Non-response adjustment
  - Need to increase sample size to compensate for anticipated non-response at beneficiary level
  - Use values from prior similar surveys in same geographic area
  - In absence of prior information, assume 5% non-response or adj_{NR} **= 1/(1-0.05)**

Calculate the Sample Size



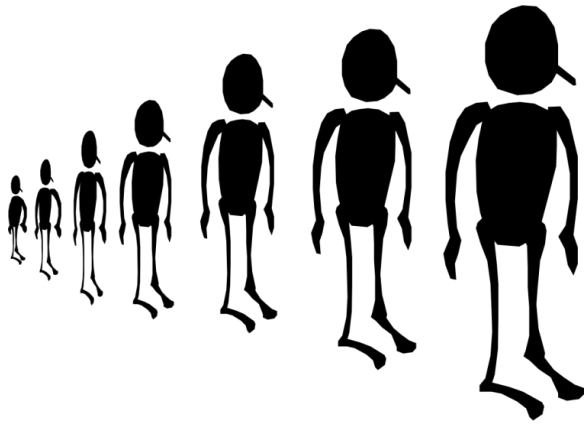
Example: Value of Incremental Sales (continued)

- $\boldsymbol{adj_{FPC}}$ = Finite Population Correction adjustment
  - Check: $\boldsymbol{n_{initial}}$ = 246 is not greater than $\boldsymbol{0.05 * N = 0.05 * 60{,}000 = 3{,}000}$
  - Adjustment not needed so adj_{FPC} =1
- $\boldsymbol{adj_{DEFF}}$ = Design Effect (DEFF) adjustment
  - Assume absence of prior information, so adj_{DEFF} =2
- $\boldsymbol{adj_{NR}}$= Non-response adjustment
  - Assume absence of prior information, so adj_{NR} = 1/(1-0.05)
- $\boldsymbol{final\ sample\ size = n_{final} = n_{initial} * adj_{FPC} * adj_{DEFF} * adj_{NR}}$

$$= \mathbf{246 * 1 * 2 * \frac{1}{1 - 0.05} = 518}$$

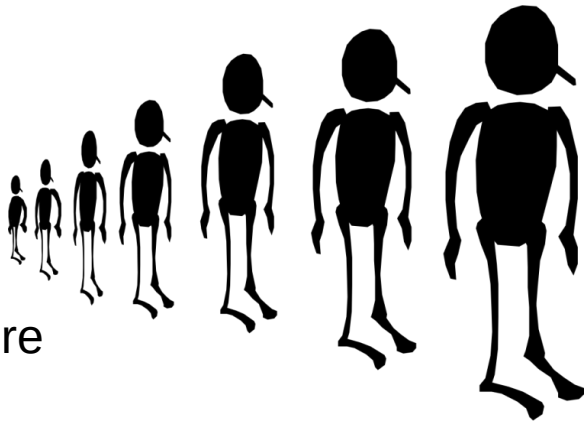
Screen shot from accompanying sample size calculator

ADJUSTMENT 1		**Use adjustment 1? (YES for all survey design options but only if $n_{\_initial}$ /N is greater than 5%)**	**NO**
Finite population correction	**$n_{initial}$ / N**	**Ratio of initial sample size to population size (%)**	**0.4%**
	n_{adj1}	**Adjusted sample size (1)**	**246**
ADJUSTMENT 2		**Use adjustment 2? (YES for survey design options 1,2 and 4)**	**YES**
Design effect	**D**	**Design effect**	**Enter value below:**
			2.00
	n_{adj2}	**Adjusted sample size (2)**	**492**
ADJUSTMENT 3		**Use adjustment 3? (YES for all survey design options)**	**YES**
Non-response		**Non-response rate**	**5.00%**
	n_{adj3}	**Adjusted sample size (3)**	**518**
FINAL SAMPLE SIZE	**n_{final}**	**Final sample size**	**518**



DEMONSTRATION OF EXCEL-BASED SAMPLE SIZE CALCULATOR!!

Calculate the Sample Size

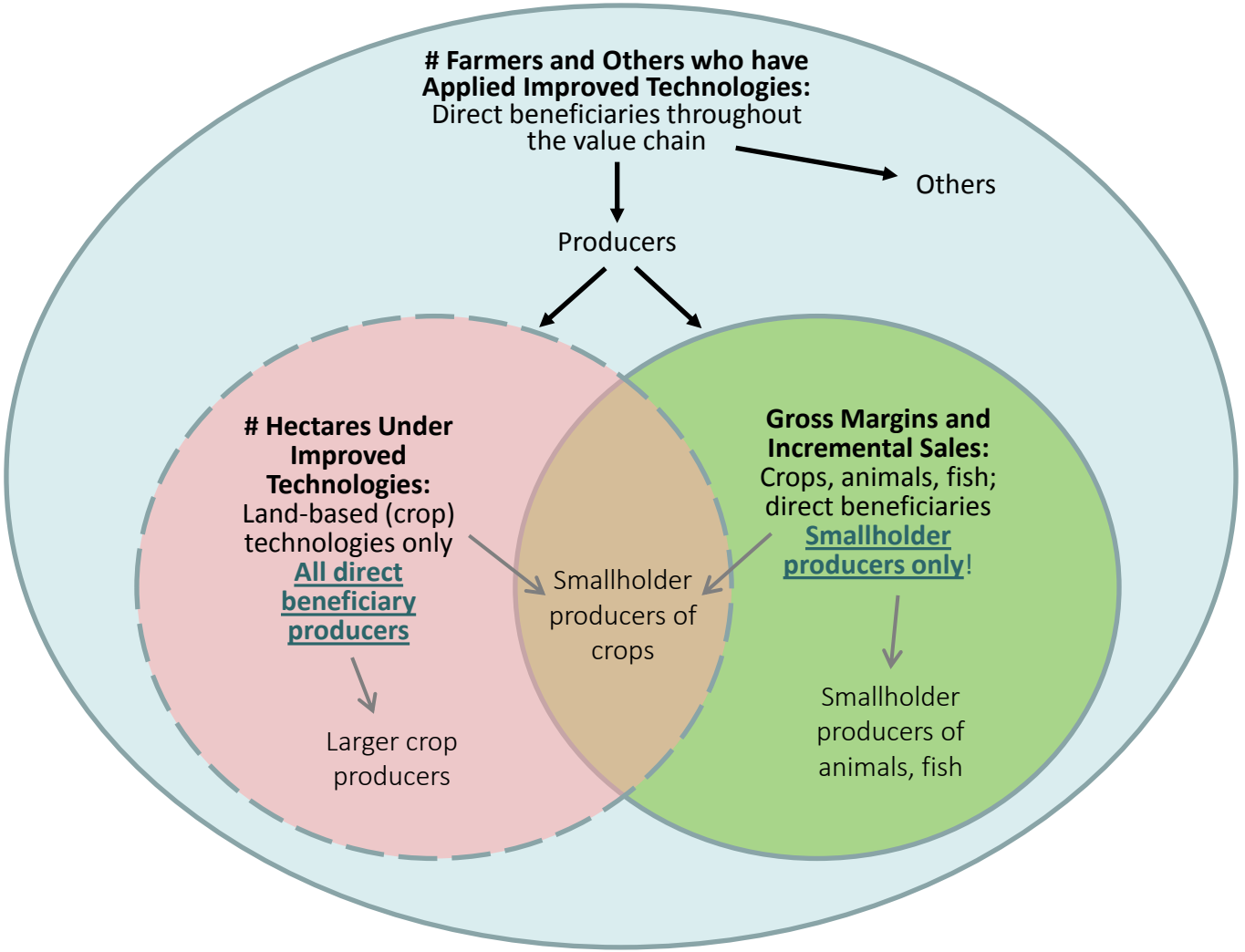


- Do similar computation for other challenging agriculture indicators (do not use Gross Margins)

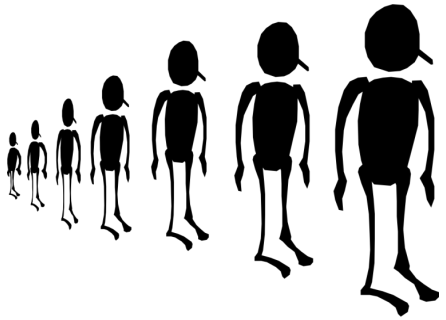
INDICATOR	FINAL SAMPLE SIZE
Value of Incremental Sales	**518**
Number of Farmers and Others who have Applied Improved Technologies	**809**
Number of Hectares of Land under Improved Technologies	**360**

- Take largest (affordable) sample size among all sample sizes computed
- ”Number of Farmers and Others who have Applied Improved Technologies” is indicator with greatest sample size requirement, so overall sample size for survey is 809

Calculate the Sample Size:
Four Challenging Agriculture-based Annual Monitoring Indicators



Calculate the Sample Size

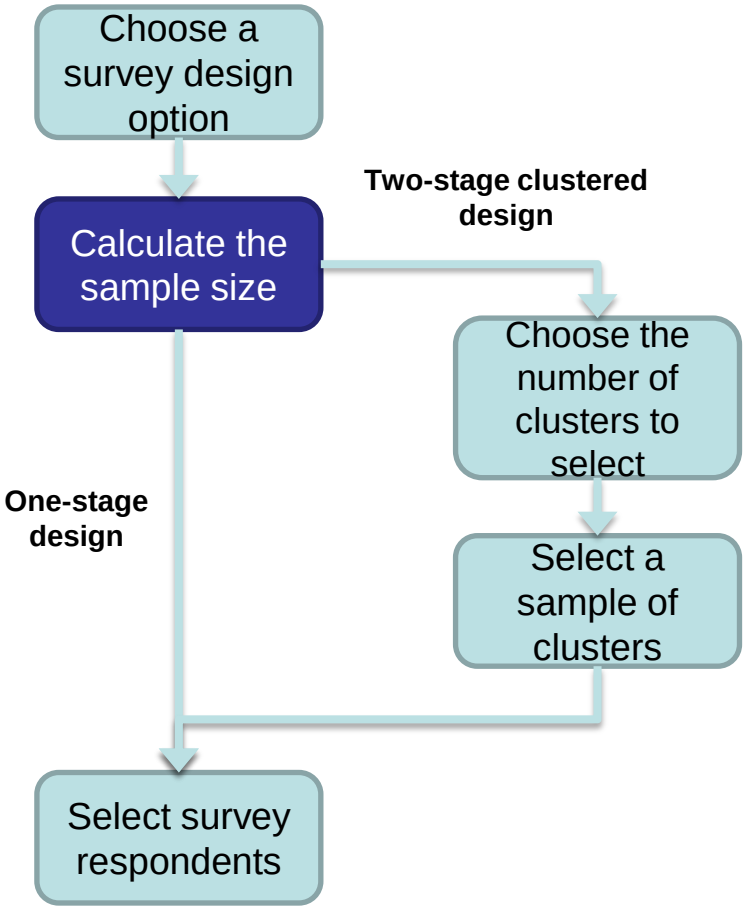


It is recommended to use a minimum sample size of 525 beneficiaries (including inflation for non-response) for any BBS

Why?

- To ensure reasonable precision for Feed the Future required disaggregates
- To ensure reasonable precision for any district or other sub-project geographic areas for which IPs wish to produce estimates
- To compensate for diminished sample size due to screening out of non-small holder farmers for Gross Margins and Value of Incremental Sales indicators
- To justify base cost of survey

Survey Design Steps for Drawing a Sample Using Approaches 1 & 2



After data collection, analysis…

- Data entry (if not using a tablet or PDA)
- Data cleaning (consistency and logic checks)
- Production of sampling weights to take into account:
  - Probability of selection at each stage of sampling
  - Non-response at individual beneficiary level
- Production of estimates of indicators (using software packages)
- Production of associated confidence intervals and standard errors (using software packages)

- Contact me at:

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- Link to guide and calculator can be found at:

https://agrilinks.org/library/sampling-guide-beneficiary-based-surveys-select-feed-future-agricultural-annual-monitoring

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